

# **PostCOVID Exercises in the Water**

Dorica Šajber, Barbara Gilić, Tomislav Okičić, Marko Djurović, Katarina Praznik, Robert Marčun, Goran Dimitrić, Milivoj Dopsaj, Mia Perić

*Educational Research Institute*

Ljubljana, September 2023



Co-funded by the  
Erasmus+ Programme  
of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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Language editing:

Publisher:

For publisher:

Available at: <https://>

This research forms part of the project

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# PostCovid Exercises in the Water

<b>PROJECT COORDINATOR</b>	Plavalna zveza Slovenije
<b>PROJECT NO.</b>	101050089
<b>PROJECT TITLE OR TITLE OF CONTRACTUAL CONTENT</b>	ERASMUS-SPORT-2021-SSCP — Small Scale Partnerships
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Project Partners:



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## Preface

What is this script about and to whom it is intended

The main project objective is to establish a training program offering quality and systematic treatment to the target groups, and consequently to the final users, providing a healthy and safe return to the daily life of persons, who recovered from COVID-19. The program will be based on theoretical as well as practical design, and will be supported with numerous intellectual outputs, in the light of professional and scientific content and digital questionnaires.

- The disease COVID-19 will always be with us and its consequences are serious for some persons
- A similar approach for all individuals with different lung diseases (cancer, COPD...), which are becoming more common due to various environmental factors





## 1. INTRODUCTION

### 1.1. General about the disease COVID-19

The new coronavirus that was discovered in China at the end of 2019 is called SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2), and the disease it causes is called COVID-19. In March 2020, the World Health Organization declared the COVID-19 a global pandemic and has become a major health problem. The virus can cause mild flu-like symptoms such as: fever, cough, difficulty breathing, muscle pain and fatigue. In more severe cases, severe pneumonia, acute respiratory distress syndrome, sepsis and septic shock occur, which can cause the death of the patient. According to previous analyses, in about 80% of cases, the infection with COVID-19 causes a mild disease (without pneumonia or mild pneumonia) and most of the patients recover, 14% have a more severe disease, and 6% have a severe form of the disease. The majority of severe cases and deaths occurred among seniors and those with other chronic diseases. To date, 249 743 428 confirmed cases of infection have been recorded in the world, of which there were 5 047 652 deaths, while 171 866 09 cases of infection and 232 980 deaths have been recorded in Slovenia.

Studies researching the consequences of the disease COVID-19 on infected patients have shown that the lungs are most affected (Torres-Castro et al., 2020). Therefore, the most common consequences after COVID-19 are difficulty breathing/dyspnoea and fatigue. In accordance with the above, numerous studies have reported that people who suffered from the COVID-19 disease have impaired performance of activities of daily life (Pizarro-Pennarolli et al., 2021). Other common symptoms and sequelae of COVID-19 are mainly neuromuscular, including muscle pain and weakness (myopathy), joint stiffness and pain, and reduced physical fitness (Carda et al., 2020; Huang et al., 2021). One study found that individuals with post-COVID conditions were able to walk shorter distances due to muscle weakness, joint pain, and fatigue, even 6 months after infection with COVID-19 (Huang et al., 2021).

## 2. Consequences of the disease COVID-19

The symptoms of COVID-19 usually improve within a few weeks for most people. Symptoms can last for a longer period for certain people, particularly those who are seriously ill and require hospitalization. They can be mild or more severe.

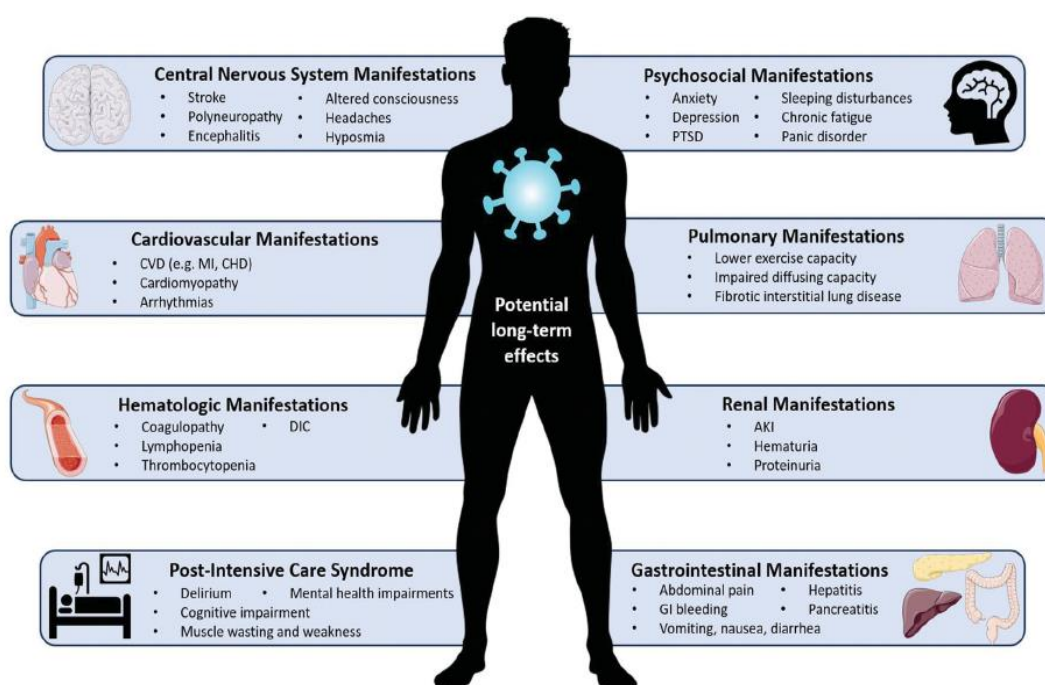
Although doctors are still learning about COVID-19, they generally describe two phases of illness and recovery:

- a. Acute COVID-19 – is characterized by symptoms that last up to 4 weeks after a person is infected. The majority of individuals with mild COVID-19 do not experience any symptoms after this stage, but some do.
- b. Post-COVID conditions – are symptoms that last longer than 3 months after infection. This is more common in people who have been critically ill, meaning they have had to stay in the intensive care unit ("ICU"), be put on a mechanical ventilator (breathing machine), or have other types of breathing aids. When people have persistent symptoms, meaning symptoms that last longer than a few months, different terms are used. "Long-COVID", "chronic COVID" and "post-COVID-19 syndrome" are examples of these.

## 2.1. Symptoms of the disease COVID-19 that can last longer

Symptoms that are more likely to last longer than a few weeks include: difficult breathing, general tiredness, chest discomfort, cough. Other physical symptoms may also continue after several weeks. These include problems with smell or taste, headache, runny nose, joint or muscle pain, trouble sleeping or eating, sweating, and diarrhoea. Some people also have ongoing psychological symptoms. These may include: Difficulty thinking clearly, focusing or remembering, depression, anxiety or a related condition called post-traumatic stress disorder ("PTSD").

A recent study reported that up to 76% of patients reported at least one symptom 6 months after symptom onset, and this proportion was higher in women. The most common symptoms were fatigue or muscle weakness and difficulty sleeping. Additionally, 23% of patients reported anxiety or depression after 6 months of illness. The percentage of patients with pulmonary diffusion abnormalities during follow-up is higher in patients with more severe disease in the acute phase (Huang et al., 2021).



**Figure 1.** Potential long-term effects of SARS-CoV-2 infection. Potential pulmonary and extra-pulmonary manifestations of COVID-19 are presented based on a review of documented long-term effects of SARS-CoV-1 and MERS-CoV, as well as COVID-19 manifestations documented to date. The most notable potential long-term effects involve the central nervous system, psychosocial, cardiovascular, pulmonary, hematologic, renal, and gastrointestinal manifestations, as well as the post-intensive care syndrome. COVID-19, coronavirus disease 2019; MERS-CoV, Middle East respiratory syndrome coronavirus; SARS-CoV-1, severe acute respiratory distress syndrome coronavirus 1; SARS-CoV-2, severe acute respiratory distress syndrome coronavirus 2; CHD, coronary heart disease; GI, gastrointestinal; MI, myocardial infarction.

*Figure 1. Possible long-term consequences of the disease COVID-19 (Higgins et. al. 2021)*



Most people, who get over COVID-19 make a full recovery, but about 10%-20% of people experience medium to long-term effects after overcoming the disease, which is known as post-COVID-19 or long-term COVID.

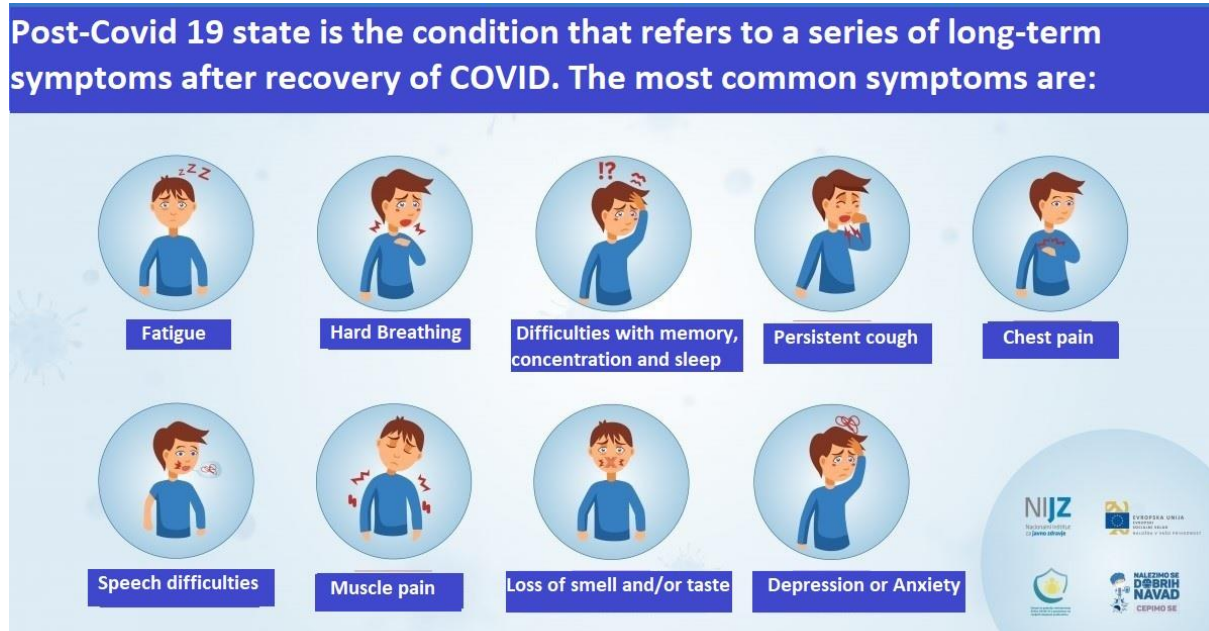


Figure 2. Most common symptoms of Post-COVID 19 (NIJZ)

Alleviating symptoms and strengthening health is important for people whose symptoms of the disease COVID-19 last 12 weeks or longer, especially in areas where the greatest decline and deficit due to the disease is visible Compared to the state before the disease.

Exercising in water, which includes aerobic exercises, muscle strengthening exercises, balance exercises and breathing exercises, is recommended for people who have been hospitalized and have a more severe disease course and/or associated diseases. The training rehabilitation process in the water should include the proposed breathing exercises, given the effects of COVID-19 on the respiratory system.

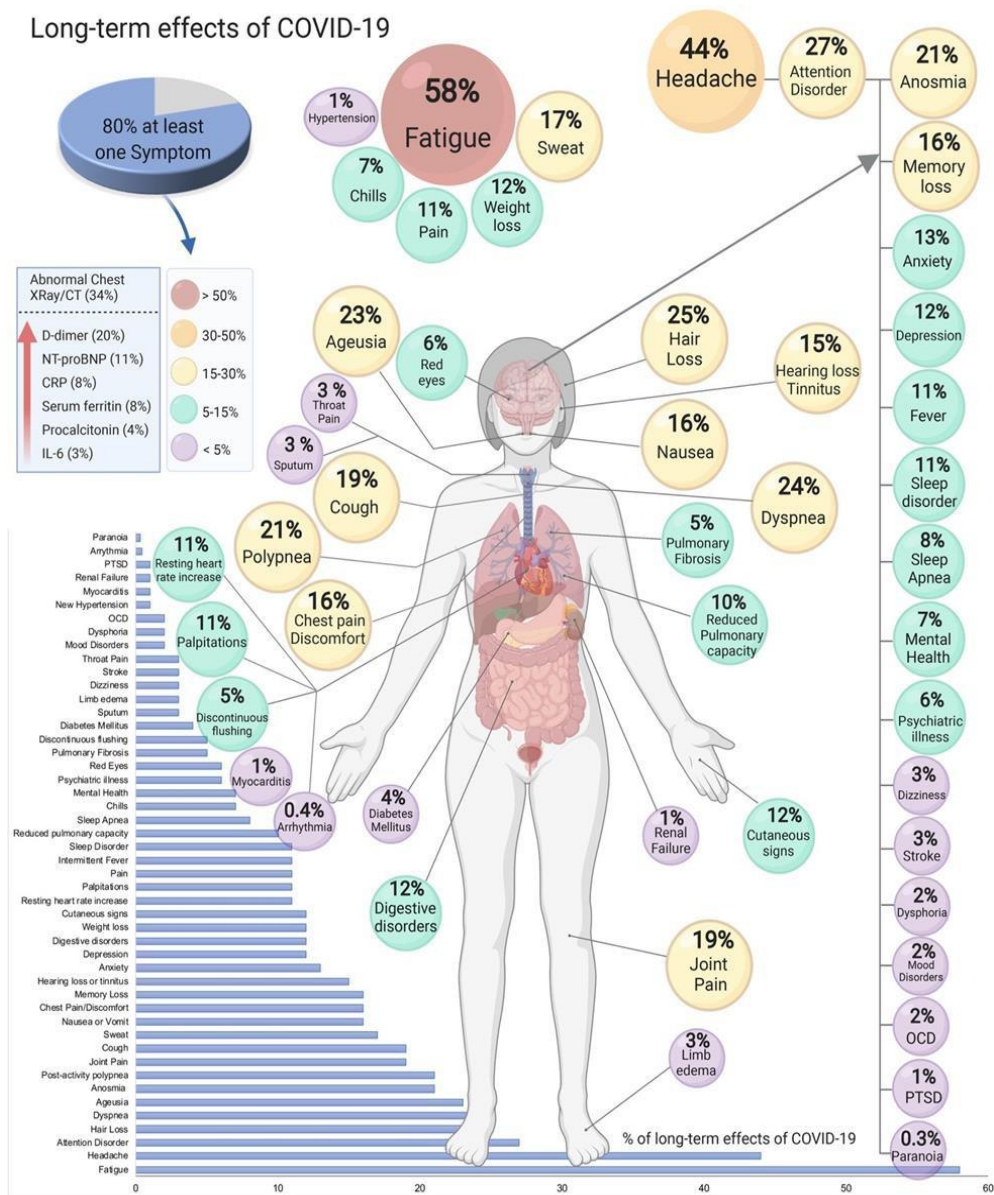


Figure 3. Long-term effects of COVID-19

Pie chart and table: 80 % have at least one symptom: abnormal chest X-ray (34%), D dimer, NT-proBNP, CRP, serum ferritin, procalcitonin, IL-6

Chart from top to bottom: paranoia, arrhythmia, PTSD, renal failure, myocarditis, new-onset hypertension, OCD (obsessive-compulsive disorder), dysphoria, mood disturbance, sore throat, stroke, vertigo, swelling of extremities, sputum, diabetes, blushing, pulmonary fibrosis, red eyes, psychiatric illness, mental health, chills, sleep apnoea, reduced lung capacity, sleep disturbances, occasional fever, pain, palpitations, elevated resting heart rate, skin rashes, weight loss, indigestion, depression, anxiety, hearing loss or tinnitus (whistling, ringing in the ears), memory loss, chest pain, nausea or vomiting, sweating, cough, joint pain, polypnea (increased rate and depth of breathing) after physical activity, loss of smell, loss of taste, difficulty breathing, hair loss, attention disturbances, headache, fatigue.



### 3. General decline in physical abilities (deconditioning)

The majority of patients who recovered from the disease COVID-19 had a worse performance in the 6-minute walk test compared to subjects who were healthy (Carda et al., 2020). The decline in physical abilities is most likely not only a consequence of lack of movement but also of myopathy and dysfunction of the heart and nervous system (Hui et al., 2005). Numerous studies have revealed a reduction in the ability to perform daily life activities, revealing a significant deterioration of functional abilities essential for performing daily activities and a consequent loss of independence in patients suffering from COVID-19 after the acute phase of infection. Functional capacity status prior to COVID-19 is critical for predicting disease severity and mortality. Those who performed worse in activities after infection were older patients and/or patients who had complications during their hospital stay, such as admission to intensive care, use of mechanical ventilation, delirium, cerebral microbleeds, leukoencephalopathy, or greater need for oxygen (Pizarro-Pennarolli et al., 2020).

#### 3.1. Instructions for treatment of patients who have recovered from COVID-19

It is difficult for doctors to predict when symptoms will improve because it varies from person to person. However, people who have contracted COVID-19 are recommended to undergo a rehabilitation program that includes breathing exercises, exercises to improve the body's functional capacity (aerobic exercises), and muscle strengthening exercises (Wang et al., 2020).

#### 3.2. Guidelines for therapeutic exercises for people who have recovered from COVID-19

**Breathing exercises** are crucial for patients' recovery and return to daily activities. Diaphragmatic breathing involves teaching the patient to predominantly engage the diaphragm while minimizing the activity of accessory muscles. Nasal inhalation should be encouraged to facilitate activation of the respiratory muscles. Active contraction of the abdominal muscles should occur at the end of exhalation to increase the abdominal pressure and to better activate the diaphragm.

Likewise, exercise is a key component of pulmonary rehabilitation. Mobility exercises can be started in bed in a very deconditioned patient, walking in an ambulatory patient, and strength and aerobic exercises in a patient in a further phase of recovery. Rehabilitation intervention should aim for an SpO<sub>2</sub> > 90% with supplemental oxygen titration to maintain target oxygen saturation. The **patient's posture** when performing breathing exercises and other therapeutic exercises greatly affects the targeted activation and recovery of individual parts of the respiratory system. Targeted body positioning can be used to improve ventilation, perfusion, oxygenation, and secretion mobilization in specific lung regions affected by gravity as ventilation changes with body position. Two minutes in each body position during breathing exercises may be sufficient for ventilation/perfusion of targeted lung segments. In the upright position, ventilation occurs primarily in the middle and lower lobes with perfusion greatest in the lower lobes. The supine position also provides the best ventilation in the upper lobes of the lungs. A 2-minute supine position on the chest may help ventilate the dorsal part of the lung by decreasing compression of the lung by the heart due to ventral displacement of the heart and increasing end-expiratory transpulmonary pressure and expiratory reserve volume, as well as homogeneous anterior posterior lung inflation, and improved overall oxygenation. Chest recumbency has been used in intensive care to improve gas exchange in ARDS in mechanically ventilated patients (Wang et al., 2020).



Timely **respiratory rehabilitation** could improve recovery, maximize preservation of functionality and improve quality of life. One study examined the effects of 6 weeks of respiratory rehabilitation in elderly patients recovering from COVID-19 (Liu et al., 2020). Tests used in the study included pulmonary function tests including plethysmography and diffuse lung capacity for carbon monoxide (DLCO), functional tests (6-minute walk), quality of life assessments (SF-36 questionnaire), and activities of daily living (measuring functional independence), and mental status tests (SAS for anxiety and SDS for depression). The intervention included respiratory muscle training, coughing exercises, diaphragm training, and stretching exercises. After 6 weeks of respiratory rehabilitation, significant improvements were noted in FEV1(L), FVC(L), FEV1/FVC%, DLCO% and the 6-minute walk test in subjects who participated in the intervention. Furthermore, patients who participated in the intervention were assessed a better quality of life, as well as reduced anxiety and depression after the intervention. The mechanism of the effect of exercise on pulmonary disease rehabilitation mainly relates to the improvement of ventilation and gas exchange functions, cardiovascular functions, and functionality of skeletal muscles in patients.

There is a demonstrated role of aerobic capacity in maintaining, restoring, or improving lung capacity (Mohamed & Alawna, 2020). Improving aerobic capacity has been shown to be more important and effective than respiratory exercise in improving lung function (Evaristo et al., 2020). Therefore, it could be suggested that participation in activities that increase aerobic capacity is critical for restoring normal lung function, which is most commonly and frequently affected in COVID-19 patients.

Given that a large number of COVID-19 patients have long-term consequences of the disease, there are clinics that provide recovery services for the pulmonary, nervous and muscular systems for COVID patients. The number of targeted programs designed for the rehabilitation of COVID-19 patients is limited, and most programs focus on exercises on dry land. However, there is a lack of programs based on aquatic exercises. Considering that aquatic exercise offers numerous benefits and opportunities for the recovery of COVID-19 patients, the following text presents the basic features of aquatic exercise and, finally, guidelines and examples for aquatic exercise for post-COVID patients.



## 4. POST-COVID, according to the Slovenian National Public Health Institute - NIJZ

### 4.1. Recommended interventions to address the symptoms of long-term COVID

Post-COVID conditions	Interventions for rehabilitation of post-COVID conditions	Potential interventions for rehabilitation of post-COVID conditions with water exercise
Fatigue	Sleep hygiene, gradual increase in physical activity, breathing and relaxation techniques, cognitive behavioural therapy, healthy lifestyle, pace adjustment, planning, prioritisation...	<ul style="list-style-type: none"> <li>- Gymnastics in the water,</li> <li>- Slow swimming</li> <li>- Sliding</li> <li>- Aerobics in the water</li> <li>- Fitness aerobics</li> </ul>
Dyspnoea on exertion	Improving breathing: breathing techniques; aerobic exercise; muscle strengthening ...	<ul style="list-style-type: none"> <li>- Exhaling into the water at the edge of the pool, also as a form of a break</li> <li>- Gliding with length extension</li> <li>- Slow swimming</li> <li>- Aerobics in the water with a pool noodle</li> <li>- Yoga swimming</li> <li>- Resistance of the water also strengthens breathing muscles</li> </ul>
Cough	Dry cough: hydration, gargling, pastilles	<ul style="list-style-type: none"> <li>- Humid air in the indoor pool</li> </ul>
Anxiety	Cognitive behavioural therapy, sleep hygiene, relaxation and breathing techniques, psychotherapy...	<ul style="list-style-type: none"> <li>- Companionship and socialisation</li> <li>- Water games, fun</li> <li>- Better sleep after exercising in the water</li> <li>- Breathing technique – short inhalation and prolonged exhalation</li> <li>- Buoyancy – starfish, relaxation under buoyancy force</li> </ul>



Post-COVID conditions	Interventions for rehabilitation of post-COVID conditions	Potential interventions for rehabilitation of post-COVID conditions with water exercise
Brain fog	Sleep hygiene, relaxation and breathing techniques, cognitive reorientation, brain training (puzzles, word games), aerobic exercise, Mediterranean diet...	<ul style="list-style-type: none"> <li>- Interaction and socialisation</li> <li>- Water games, fun</li> <li>- Water games with puzzles and word games – counting boom, 1,2,3.</li> <li>- Better sleep after water exercise</li> <li>- Breathing technique for swimming – short inhalation and prolonged exhalation</li> <li>- Yoga swimming</li> <li>- Buoyancy – resting on the surface – starfish, relaxing when buoyancy force is applied</li> </ul>
Concentration problems	Reduced distractions, time to do more challenging tasks, quiet space, listening to calm music to focus, regular breaks...	<ul style="list-style-type: none"> <li>- In the water, we are alone with ourselves</li> <li>- The starfish position, slow swim or long glide positions release nerves and tension</li> </ul>
Memory problems	Using a calendar with reminders and to-do notes, taking photos of visual information, which must be remembered and writing them down in a notebook.	<ul style="list-style-type: none"> <li>- Giving following exercises with frequent alternation of different exercises, as in swimming exercises, as in aerobics exercises - those that require memorisation</li> </ul>
Chronic pain	Physical methods, cognitive behavioural therapy, relaxation and breathing techniques, personalised exercise programme...	<ul style="list-style-type: none"> <li>- Water and movement in water may help relieve chronic pain, and due to buoyancy exercises can be carried out, that cannot be performed on dry land</li> <li>- Due to the greater resistance of the water, we also work on strength</li> <li>- Swimming itself is a relaxation technique</li> <li>- While swimming we constantly do breathing exercises</li> </ul>

**Table 1. Table of Recommended interventions to address the symptoms of long-term COVID**





#### 4.2. **Aerobic exercise recommendations for individuals with long-term COVID**

- Regularly perform light to moderate intensity aerobic exercise (e.g., walking, jogging, swimming, cycling) (up to 70% of maximum heart rate) 2-3 times/week for 20-60 minutes.
- If the exerciser does not feel tired or exhausted after the exercise, he/she can perform it several times (5 times) a week.
- Recovered patients may divide the duration (amount) of exercise into several shorter units to reduce excessive tiredness and fatigue.
- For individuals who tire easily, shorter intervals or training breaks are recommended.

Aerobic exercise that does not result in exhaustion helps to strengthen immune function. Increasing aerobic capacity reduces the severity of the disease. In seniors, where the immune system is weakened by age, prolonged aerobic exercise reduces the risk of respiratory viral diseases (such as influenza) and improves the immune response (33).

#### 4.3. **Recommendations for muscle strengthening exercises for individuals with long-term COVID-19**

Muscle-strengthening exercises do not require as much oxygen from the body as aerobic exercises, so individuals with dyspnoea (breathing difficulties) can do them more easily. The loads should be large enough to elicit a muscle response that is 50-85% of the 1RM (one repetition maximum). In practice, this means that a person can perform 6-12 repetitions of the chosen exercise for a given load. If he manages 1-2 repetitions more than planned, we increase the load by 2-10 %.

For muscle-strengthening exercise, it is recommended to:

- Engage the large muscle groups of the upper and lower limbs (squats with support on an elevated surface, standing up from a chair/squat, hip raises in supine position, toe raises, etc.).
- Incorporation of light to moderately heavy loads. The participant must be able to perform 2-4 sets of 6-12 repetitions of each exercise of the chosen intensity.
- 2 times/week we also integrate exercises to improve balance and strengthen the muscles.

#### 4.4. **Exercise recommendations to improve balance and maintain mobility**

Exercises that target improving balance and mobility in individuals with long-term Covid-19 symptoms are not specific. We adhere to the basic principles and tenets of this type of exercise.

For seniors and adults with chronic conditions, it is important to perform a variety of multi-component physical activities that focus on functional balance. To enhance functional abilities and prevent falls, it is recommended to exercise at least three times a week as part of your weekly routine.

Exercises to maintain flexibility should be part of every training session. The focus is on the major muscle groups and those that have been most used during the exercise. Static stretches are held for 20-30 seconds, with at least 2 repetitions.



#### 4.4.1. Physical activity escalation algorithm for individuals with long-term COVID-19 in Workshops of Slovenian HEALTH EDUCATION CENTRES and HEALTH PROMOTION CENTRES

Physical activity should be initiated by the person when they are ready to do so, and meets the requirements for participating in the workshop as assessed by a doctor or registered nurse.

If the person is physically fitter than level 1 of the escalation and returns to the physical activity algorithm (Table 4), they can skip and start at level 2.

If the person is physically fitter than the first stage of escalation and anticipates a return to physical activity (Table 4), they can skip the first stage and start the second stage.

MILD	MODERATE	SEVERE/CRITICAL
<p>The person <b>HAS</b> different signs/symptoms (any of the following):</p> <ul style="list-style-type: none"> <li>• elevated body temperature,</li> <li>• cough,</li> <li>• dry throat,</li> <li>• general malaise,</li> <li>• headache,</li> <li>• muscle pain,</li> <li>• nausea, vomiting, diarrhea</li> <li>• loss of smell or taste</li> </ul> <p>The person <b>DOES NOT HAVE</b> the following signs/ symptoms:</p> <ul style="list-style-type: none"> <li>• shortness of breath,</li> <li>• difficulty breathing,</li> <li>• changes in the lungs (if imaging was done).</li> </ul>	<p>The person shows signs of the lower respiratory disease based (on any of the below):</p> <ul style="list-style-type: none"> <li>• clinical examination/ testing</li> <li>• imaging examination</li> </ul> <p><b>AND</b> has:</p> <ul style="list-style-type: none"> <li>• SpO2 <math>\geq</math> 94% (for people with otherwise normal SpO2 values at rest)</li> </ul>	<p>Severe form: the person has (any of the following):</p> <ul style="list-style-type: none"> <li>• SpO2 <math>\leq</math> 94% (for people with otherwise normal SpO2 values at rest)</li> <li>• the ratio of partial pressure of oxygen and inspired oxygen (PaO2/FiO2) <math>&lt;</math> 300 mmHg</li> <li>• respiratory rate <math>&gt;</math> 30 breaths/minute</li> <li>• pulmonary infiltrates <math>&gt;</math> 50 %</li> </ul> <p><b>Critical form:</b> in the person was present (any of the following)</p> <ul style="list-style-type: none"> <li>• respiratory failure,</li> <li>• septic shock,</li> <li>• dysfunction or failure of multiple organ systems.</li> </ul>

Table 2. Definition of the degree of severity of the course of the disease COVID-19 in the acute phase (adapted from: Cantrill S, Fengler B, 2021).



## 4.5. Purpose

Relieving symptoms and improving health in people whose symptoms of COVID-19 persist for 12 weeks or longer, particularly in areas where the most severe disease-related declines and deficits are evident compared to the pre-disease state.

## 4.6. Objectives

1. To empower participants to self-manage their symptoms and prevent them from worsening in all areas of their health.
2. To empower participants to resume all daily activities as they did before the disease, including work performance.
3. Using appropriate resources (such as relaxation techniques, rainbow walking program, healthy diet, etc.) to encourage independent activities for a healthy and active lifestyle.

An integrated rehabilitation process is recommended when treating individuals with long-term COVID-19, thus a treatment that combines neuromuscular, cardiovascular, respiratory, and psychological support, with the aim of enhancing the individual's quality of life.

Physical activity is heavily emphasised, and it should be increasingly understood less as a “hobby for the individual” and more as a necessary activity for everyone and promoted as such (23).

## 5. Physical activities in water, swimming, buoyancy, Archimedes' Law

Swimming is a form of exercise that exerts minimal pressure on the joints, enables easier movement and provides an excellent opportunity to develop muscle strength, cardiorespiratory endurance and flexibility during swimming itself, i.e., without changing the functional pattern of movement (Dunlap, 2009). Different forms of swimming develop motor control and body awareness, including improving coordination of arm and leg movements through maintaining buoyancy and breathing control (Dunlap, 2009). For people who cannot participate in physical activities on land such as running, cycling, etc., swimming can be the only form of physical exercise. When exercising in water, the risks associated with joint loading are reduced and it is possible to increase the intensity more easily and efficiently when applying exercises for the development of strength and aerobic endurance compared to exercises on dry land (Kelly et al., 2005; Hall, Skevington, Maddison, & Chapman, 1996).

### 5.1. Physical Activities in Water

During the 1960s and 1970s, the development of adaptive activities in the water gained momentum, driven by the recognition that individuals, regardless of their physical abilities or disabilities, should have the opportunity to acquire basic swimming skills. The evolution of aquatic exercise programs for individuals with limited mobility progressed from hydrotherapy to encompass adaptive aquatic activities and therapeutic swimming programs (Sherrill & Dummer, 2004). The application of water-based physical activities for individuals with injuries to the musculoskeletal system or other health conditions requires modifying the methods of swimming instruction and other aquatic activities to suit the specific degree of impairment. The objectives of these programs include enhancing overall fitness, swimming proficiency, and the overall quality of leisure time (Lepore, Gayle, & Stevens, 2007).



In conjunction with land-based exercise programs, swimming, aquatic exercise, and other water-based activities can be incorporated into the rehabilitation process for individuals with various injuries to the musculoskeletal system, as well as those with other medical conditions such as Alzheimer's, circulatory issues, neurological manifestations, and more. Individuals facing mobility challenges can benefit from different forms of swimming, exercise, and other physical activities in water to enhance their motor functional status, improve walking abilities, and develop overall motor skills and capabilities.

## 5.2. Effects of Exercise in Water

The unique physical properties of water, including buoyancy force, hydrostatic pressure, and viscosity, contribute to the positive effects of exercise for therapeutic purposes. Thrust force refers to the upward or surface-directed force exerted by water, counteracting the gravitational force of the Earth. When standing upright with the water level up to the chin or seventh cervical vertebra, a person typically feels only 10% of their weight compared to dry land, and approximately 25% when lightly walking in water (Irion, 2009). As the water level lowers towards the feet, the sensation of body weight increases due to the influence of gravity (Becker, 2009). The combination of buoyancy force and hydrostatic pressure plays a crucial role in regulating effort during movement execution, enabling the development of essential functional skills such as sitting, standing, turning, and walking (Hanlon & Hines, 2007). Water's buoyancy force also serves as a facilitator for initiating movement when the neuromuscular system is unable to do so effectively on land (Hutzler, Chacham, Bergman, & Szeinberg, 1998). Many individuals with various musculoskeletal injuries and medical conditions can achieve independent walking in water, whereas they may require assistance when walking on dry land (Lepore, 2005). Hydrostatic pressure, another key characteristic of water, significantly impacts the cardiovascular system. As the level of submersion increases, particularly towards the chin, the effects on stroke volume of the heart become more pronounced (Irion, 2009). Hydrostatic pressure also influences the respiratory system by providing additional stimulation to proprioceptors and increasing pressure on the lungs and respiratory muscles during water-based exercise and swimming. Consequently, hydrostatic pressure positively contributes to strengthening respiratory muscles, improving breathing control, increasing vital capacity, and enhancing motor control related to speech and feeding (Hutzler et al., 1998; Lepore, 2005). The viscosity of water refers to the internal friction between its individual molecules. This viscosity allows for the creation of resistance when performing movements in water, leading to muscle strengthening. The resistance provided by viscosity increases as the force exerted on the water intensifies but rapidly decreases to zero once the force is discontinued. This property of water helps in preventing injuries and enhances control during strength exercises performed in water (Becker, 2009). By adjusting the speed of movement and the surface area of body parts moving through water, it is possible to modify the resistance created by water viscosity. This enables a gradual increase in exercise intensity (Irion, 2009).

Water temperature is classified into different ranges based on degrees Celsius: cold (10-20°C), fresh (21-27°C), lukewarm (28-33°C), indifferent (34-35°C), warm (36-38°C), and hot (39-42°C). The therapeutic effect of aquatic exercise depends on the specific type of exercise, treatment duration, and water temperature. During exercise, circulation is enhanced, and weakened joints and muscles are mobilized. The combination of warm water and exercise raises the body temperature, leading to the dilation of blood vessels and improved peripheral circulation (Hall, Bisson, & O'Hare, 1990; Epstein, 1992).



### 5.3. Forms of Exercise

The range of sports activities may vary based on the physical capabilities of each individual. Nevertheless, it is certain that regardless of age, gender, physical limitations, or health constraints, there is an activity suitable for everyone that they can effectively participate in and manage.

Adapting swimming training for individuals with health impairments caused by COVID syndrome for the purpose of rehabilitation involves making adjustments to the swimming approach, including altering movements in the water, utilizing different swimming techniques, and modifying the training's extent and intensity. Modifying swimming techniques entails making corrections to arm and leg movements, body positioning, and breathing patterns in comparison to standard techniques. These corrections may involve adjustments to stroke frequency, stroke length, and strength, as well as variations in body positioning during breathing. Swimming training can be tailored to achieve various objectives, such as maximizing athletic performance, facilitating rehabilitation, and preventing future issues.

Aquatic exercise is highly recommended for individuals who have recovered from COVID-19 because of its positive impact on functional fitness, overall quality of life, and the alleviation of fatigue symptoms, as well as its potential to reduce shortness of breath in patients with severe symptoms. Nevertheless, there is a lack of long-term studies providing definitive guidance on the most effective and safe methods for reintroducing patients to exercise post-COVID-19. Current recommendations are primarily based on expert opinions and consensus. It is generally advised that individuals who have recovered from COVID-19 begin gradually, both in terms of the frequency of training and the intensity of the exercises, taking into account their subjective sensations. Since every individual and their clinical condition is unique, the return to exercise should be personalized and tailored to each person's specific needs.

Swimming is a water-based sport that involves synchronized movements with breathing patterns. It incorporates periods of breath-holding underwater followed by quick and deep breaths taken from the water's surface. This unique breathing technique contributes to aquatic athletes having greater lung capacity and enhanced lung diffusion capacity compared to other athletes and the general population.

The disease COVID-19 caused by the SARS-coronavirus-2 has brought significant attention to respiratory health. Certain factors, such as advanced age and obesity, have been associated with an increased risk of hospitalization and death. Conversely, exercise capacity has been identified as a beneficial factor in mitigating the clinical severity of COVID-19 infection.

Individuals who have experienced severe illness, complications such as blood clots or myocarditis, or have become long-haulers (experiencing long-term effects) need to exercise caution and consult with their doctor before resuming activities. It is advisable for them to wait longer before returning to their regular activities, and their plans should be discussed and approved by their healthcare professional.

Furthermore, individuals who have experienced a mild or suspected COVID-19 infection may also need to wait before resuming exercise. Even in these cases, certain issues such as acute myocarditis leading to heart damage, increased risk of blood clotting, as well as anxiety and depression, can pose challenges. When returning to exercise, it is recommended to have a training frequency of 3 to 5 times per week. During exercise, the intensity should be maintained within a heart rate reserve of 40% to 59%. The heart rate reserve is determined by the difference between the predicted maximum heart rate and the resting heart rate.

Individuals who previously engaged in swimming before contracting COVID-19 should be able to resume their regular daily activities without difficulty and should be able to walk 500 meters on flat ground without experiencing shortness of breath or severe fatigue before considering a return to swimming. It is recommended to start exercise at 50% or less of their pre-illness activity levels. For



example, if a person used to swim 3,000 meters during training, the initial training volume should be 1,500 meters or less, at a light intensity, for a minimum of two weeks. The volume can gradually increase only if the person feels well and without any negative symptoms. Monitoring subjective feelings is essential during the recovery process. Any changes, such as a sense of inadequate recovery one hour after exercise or the following day, abnormal shortness of breath, abnormal heart rate, excessive fatigue or lethargy, anxiety, or depression, should be taken seriously. Patience is crucial when resuming physical exercise after a COVID-19. Remember that there will be ample opportunities to swim, so it is important not to rush the return to full activity levels.

#### **5.4. General exercise guidelines for individuals who have recovered from COVID-19**

The available evidence on recovery and exercise after COVID-19 is limited (Salman et al., 2021), but preliminary studies have highlighted several important considerations. One primary concern is the risk of cardiac injury, including viral myocarditis, which is significant because exercising with myocarditis can lead to higher rates of illness and death. Thromboembolic complications, such as pulmonary embolism, have also been associated with COVID-19. The long-term effects on lung function are currently uncertain, although data from the 2003 outbreak of severe acute respiratory syndrome coronavirus (SARS-CoV) suggest persistent impairment of lung function and exercise capacity in survivors. Furthermore, primary psychiatric conditions like psychosis have been identified as potential features of COVID-19, and psychological consequences following infection may include post-traumatic stress disorders, anxiety, and depression.

Numerous recommendations regarding safe exercise for individuals who have recovered from COVID-19 can be found in the literature. One notable consensus (Barker-Davies et al., 2020) was developed by a panel of experts in various fields including rehabilitation, sports and exercise medicine, rheumatology, psychiatry, general practice, and psychology, within the medical rehabilitation centre at Stanford Hall, UK. This consensus was the result of assessments conducted by seven teams, each focusing on specific domains related to COVID-19 rehabilitation: pulmonary, cardiac, sports and exercise medicine, psychological, musculoskeletal, neurorehabilitation, and general medicine. The published recommendations encompass multidisciplinary rehabilitation for active individuals, including athletes, who have recovered from COVID-19.

Despite the abundance of exercise recommendations for individuals recovering from COVID-19, a general consensus emerges among most of these recommendations. It emphasizes the importance of initiating exercise early after a COVID-19 infection, while also being mindful of physical limitations to ensure a safe return to physical activity. However, for exercise guidelines beyond rehabilitation programs, particularly for recreational and elite athletes, more specific recommendations are necessary. This includes assessing the individual's fitness for their respective sport and implementing tailored exercise programs for a gradual return to sports activities. Given the current uncertainty surrounding the long-term consequences of COVID-19, it is crucial to conduct long-term follow-up studies to provide more precise exercise recommendations for individuals who have recovered from the disease. This ongoing monitoring is necessary to better understand the implications of COVID-19 and guide exercise protocols effectively.



## 5.5. Benefits of exercising in the water

Aquatic exercises or hydrotherapy is a widely known and used method for the rehabilitation of numerous musculoskeletal injuries and for improving the general state of health. Due to its specific density, water affects the body's systems, including the cardiovascular, pulmonary, and musculoskeletal systems. Namely, when an individual is immersed in water, he is subjected to an external gradient of water pressure, which leads to an increase in cardiac output, movement of blood into the chest cavity, increased work of breathing and changes in breathing dynamics, and reduced impact on the joints due to the hydrostatic effects of immersion (Becker, 2009).

### 5.5.1. Breathing system

With exercise, the need for oxygen increases compared to an inactive state. Because of this, the breathing frequency, respiratory volume and minute breathing volume increase. Exercising while the body is immersed in water places greater demands on the respiratory system, most notably on inspiratory muscle strength, suggesting that this form of exercise can develop respiratory muscles and improve lung function.

Likewise, swimming improves the ability to regulate breathing patterns in terms of regulating volume and air flow more than other activities and sports. Swimming places high demands on the inspiratory muscles; immersion and movement in water forces individuals to expand the chest against greater pressure while simultaneously increasing the rate and force of inspiratory muscle contraction and increasing tidal volume. Therefore, swimmers are known to have exceptional lung functions and volumes: large vital capacity, total lung capacity and lung diffusion capacity.

### 5.5.2. Cardiovascular system

Exercising in water affects cardiorespiratory fitness, which includes the ability of the heart, lungs and blood vessels to deliver oxygen to working muscles. Cardiorespiratory fitness is developed with activities that use large muscle groups in repetitive movements. Regular exercise also lowers blood pressure because it strengthens the heart and cholesterol in the veins and arteries. Likewise, exercise creates new capillaries, which further controls blood pressure. In addition, since the heart works closely with the lungs, exercise improves lung capacity and breathing efficiency. Through this improvement in the breathing process, exercise also helps circulate oxygen and nutrients throughout the body, helping it to work more efficiently.

The central venous pressure rises with immersion up to the chest and increases until the body is completely submerged in water. As a result, there is an increase in pulse pressure, increased cardiac output and decreased heart rate during thermoneutral or colder immersion. Central blood volume increases during immersion by approximately 0.7 L with neck-deep immersion, a 60% increase in central volume. Cardiac output increases by 27%–30% with neck-deep water immersion.

### 5.5.3. Musculoskeletal system

There is growing evidence to suggest that aquatic exercise can help with musculoskeletal problems including osteoarthritis, rheumatoid arthritis, fibromyalgia, low back pain and osteoporosis. The benefits of exercising in water derive from the physiological effects of immersion and the hydrodynamic



principles of exercising in an aquatic environment. Buoyancy reduces pressure on the joints and enables functional exercise with reduced gravitational load, improving strength and range of motion. Additionally, immersion in thermo-neutral water (34 degrees Celsius) reduces the activity of the sympathetic nervous system, which combined with the compressive effects of hydrostatic pressure can reduce swelling and pain perception in individuals with musculoskeletal problems. The aquatic environment can enable higher intensity exercise with lower cardiovascular stress than is possible on land. An aquatic exercise program can be designed to vary in intensity in terms of gravity loading using buoyancy as a counterforce. Simply put, the intensity could be adjusted according to water depth, with greater water depth (where the body weighs very little) leading to reduced stress on the joints (Becker, 2009).

#### **5.5.4. Nervous and hormonal system**

The activity of the sympathetic nervous system increases with physical exertion. This enables the cardiovascular system, thermoregulation and mechanisms for maintaining the electrolytes of body fluids to prepare for physical exertion. Blood flow to the brain increases during water exercise, potentially delivering more oxygen and nutrients to brain cells. This could help slow age-related or disease-related deterioration of the brain.

##### *Energy system and body mass*

Exercises in water allow overweight people to safely perform exercises without stressing the joints. Exercising in the water leads to energy consumption, which leads to a reduction in subcutaneous fat tissue and a reduction in body weight.

**Water exercises and swimming can be expected to restore and improve the lung function of people suffering from the disease COVID-19. Also, as the body weight is reduced in the water, it is easier and safer to move in the water for individuals with musculoskeletal pain after COVID-19.**

## **6. Exercise instructions for post-COVID patients (from the water aerobics book)**

### **6.1. Preparatory part**

#### **6.1.1. Introduction**

Communication is of utmost importance when working with seniors. It is important to establish an open, honest relationship with the trainee. The beginning of the exercise session should be more personal. A friendly welcome and a short chat will cheer the trainee up, stimulate and create a relaxed training environment.

#### **Warm up**

The warm-up phase needs to be slightly longer. Seniors require more time to prepare their bodies for physical activity as the rate at which their cardiovascular system responds to exercise slows down over the years. Let's allocate fifteen minutes for it.





The general warm-up includes active exercises, water games, and swimming. We begin with low-intensity motions like walking, first on the spot and then around, varying its forms and accompanying arm movements. Backward moves are added later in the training process if the patients have balance problems, once they become accustomed to the increased resistance of the water and strengthen their trunk muscles. Active exercises should involve the majority of joints and major muscle groups. A selected water game can be used to upgrade the general warm-up. Spend a few minutes swimming before starting the main part of the training unit.

## **6.2. Main part**

### **6.2.1. Aerobic part**

Aerobic exercise is typically done for 15 to 20 minutes. Extending it depends on the training unit's objectives, patient health, and physical performance progress.

While interspersing basic movements with lively music, it is important to remember that the sensation of exertion varies from person to person. Introducing the movements at different levels of intensity is crucial. Students can tailor the workout to their abilities, goals, and current well-being in this manner. Also, when assessing exercise intensity, it is better to pay more attention to the well-being of the patients and to the external signs of exercise intensity than to the heart rate.

Continuously observe the patients during the guided exercise. If a patient's health deteriorates temporarily, they should stop training immediately. Heart problems (chest pain, cardiac arrhythmia), malaise, dizziness or slight headache, nausea, and severe joint pain that increases with movement should be given special attention.

### **6.3. Strengthening part**

The strengthening phase lasts between 20 and 25 minutes, and it can be done completely after the aerobic workout or divided into two parts. The warm-up is followed by the first part, which focuses on strengthening the upper body, and the second part, which focuses on strengthening the lower body, is followed by the aerobic workout.

The patients are constantly reminded of the correct execution of each exercise, proper posture, and proper breathing. We motivate them to persist, explaining the effects of a particular exercise and which muscles are active. For more challenging exercises, we demonstrate the possibility of performing them at different levels of intensity.

### **6.4. Final part**

The final part lasts ten minutes and consists of static muscle stretching and relaxation.

#### **6.4.1. Static stretching**

Smaller muscle groups and those that did not play a major role in the exercise (wrist and foot muscles, neck muscles) can also be included in the stretching exercise set for seniors.

### **6.5. Relaxation**

Depending on the water temperature and the intensity of the main part of the training unit, we can use one of the relaxation methods to relieve psychophysical tension in the body, a game in the water to match the final part of the training unit, swimming or breathing exercises. To strengthen the breathing



muscles while swimming, we also offer specially designed puff hats that float on the surface of the water. The users blow into them and push them forward by rotating them around their axis.

During water training, the risk of injury is practically negligible due to the way the exercise is performed and the favourable - water environment. However, when you stop exercising in the water, you must be careful when you get out. This is because the hydrodynamic and hydrostatic laws, especially hydrostatic pressure, suddenly cease to act on the body, which can cause problems for individuals with low blood pressure. For those with balance problems, it is necessary to provide some support when exiting to prevent unwanted slips and consequent knocks.

When exercising in water, the risk of injury is practically negligible due to the nature of the exercise and the favourable water environment. When we stop exercising in the water, we have to be careful when leaving the water. At this point, the hydrodynamic and hydrostatic laws, especially hydrostatic pressure, suddenly stop acting on the body, which can cause problems for individuals with low blood pressure. Individuals with balance problems should be given some support when getting out of the water to prevent unintentional slipping and subsequent impacts.

## **6.6. Guidelines for safe aquatic exercise**

### **6.6.1. Safety of exercise participants**

Ensuring the safety of the exercise participants is the professional and moral duty of the instructor. Within the framework of the pedagogical standards, the instructor is responsible for ensuring (Kapus et al., 2002):

- active safety of patients against drowning, rescues them from the water and offers first aid,
- a safe and professionally composed exercise program.

When exercising in water, there is a risk of sinking or even drowning. According to the Law on Protection against Drowning (2000), the instructor bears criminal and material responsibility for those exercising (Kapus et al., 2002). According to the Regulation on Measures for Protection against Drowning in Organised Sports Activities, especially in organised sports activities in the field of sports recreation, which are carried out by sports clubs and other providers of the annual sports programme at the provincial or municipal level are part of their activity and are led by sports professionals with the required education or training, the presence of a lifeguard is not required (Jurak, Kovač and Strel, 2002). Although an aquatic gymnastics instructor acquires all the necessary knowledge during training to become a swimming instructor, the presence of a lifeguard from the water is recommended to ensure optimal safety of patients during aquatic gymnastics programmes.

During every activity in the water, the swim lifeguard or instructor must preventively ensure active safety in and around the water by constantly observing the trainee's problems and immediately helping them. This prevents from the outset that the latter drowns under even more dangerous conditions. If the preventive measure of the lifeguard or instructor has not been carried out or has been carried out insufficiently, the drowning person can no longer hold on to the surface of the water and starts to drown. In the curative sense, the lifeguard or instructor must immediately start rescuing the person from the water. After rescuing the drowning person on land, he/she starts the appropriate first aid. This depends on the assessment of the person's condition. Depending on the condition, the lifeguard or instructor must additionally use mouth-to-mouth resuscitation and external cardiac massage during resuscitation or, more recently, a defibrillator (Kapus idr., 2004).



An important factor in ensuring active safety is also the number of patients in the group. This is influenced by several factors, the most important of which are: patients' swimming skills, training conditions (water depth, temperature, size and type of pool, etc.), material and personnel skills (number of patients, presence of a lifeguard). The instructor must have a good overview of the patients, their well-being and the correctness of the execution of each exercise.

Norms in the group of patients for aquatic gymnastics is agreed with the manager of the swimming pool, but it must not exceed twenty patients per instructor. When training in water for seniors, it is also within these limits and also depends on the state of health of the seniors. For the aqua gym programme for pregnant women, it is lower, namely from eight to twelve pregnant women per instructor.

In order to ensure safe and professional training, the instructor must familiarise the patients with general safety recommendations, provide preventive safety measures and follow safety recommendations when training in the water. When conducting the programme, he/she shall strictly observe the principles of safe physical activity, which must be in accordance with the latest state of sports and medical knowledge, and avoid dangerous movements.

To ensure safe and professional training, the diver must familiarize the diver with general safety recommendations, take care of preventive safety measures and follow the safety recommendations when practicing in the water. During the implementation of the program, he must consistently follow the principles of safe exercise, which must be in accordance with the latest knowledge of the sports and medical profession, and avoid dangerous movements.

### **6.2.1. General safety recommendations**

When practicing in the water, patients must follow the following general safety recommendations:

- Allow at least two hours between a large meal and exercise,
- Do not go into the water or onto the pool surface in general with chewing gum in your mouth.
- Do not bring glassware to the swimming pool,
- Do not allow an intoxicated person to enter the water.

### **Preventive safety measures and recommendations when exercising in the water**

The instructor arrives at the pool first, inspects the training areas and prepares everything necessary for a smooth training process. He or she checks the operation of the built-in sound system or places and connects the portable CD player and microphone safely at a suitable distance from the water surface. He or she places the selected training aids at the edge of the pool so that they are easier for the patients to reach and the training unit without unnecessary interruptions. When the patients arrive, he warns them of dangerous spots and slippery surfaces. New participants are provided with the water depth and temperature, the entry and exit point from the pool and the appropriate training equipment (non-slip shoes, a plastic bottle with a drink to replace lost fluids, socks in case of uneven floors). He or she helps them to choose a suitable depth of water where they feel safe and can keep control of their movements. Swimming skills are not a prerequisite for participation in the physical activity programme, but they provide additional opportunities for movement and ensure greater safety. The instructor needs to be familiar with the individual's attitude towards water, the degree of movement relaxation or the presence of fear in non-swimmers. He must ensure that all patients are able to return to an upright position in the event of a possible loss of balance. The ability to maintain a balanced posture in the water is the basis



of personal safety. Before starting the exercise, the instructor needs to know the health status of the patients.

For this purpose, the participants fill out a physical activity readiness questionnaire, in which they also sign that they participate in the exercise at their own risk. During the exercise, the instructor needs to observe the well-being of the patients, detect subjective signs that the exercise is too intense and seek feedback through short stimulating questions. Plan some breaks for fluid exchange and schedule them in advance. The patients can also drink several times during exercise if needed. Warm water and hydrostatic pressure stimulate the release of urine into the bladder. To avoid urinating in the pool water, the instructor advises patients to stop training for a few minutes if they feel pressure on the bladder. If one of the patients leaves the pool for a short time for any reason, he/she has to inform the instructor. After the training, the instructor is available for a few minutes for questions and advice, then clears up and is the last to leave the pool area.

### **6.2.2. Basic principles of safe training**

As instructors, we need to consider the following principles of safe training when delivering the training and point them out to the patients:

- During exercise, we must consciously maintain proper body posture and balance. We must be especially careful during strengthening exercises and repulsive movements. The spine must be straight, shoulders pushed back and down, abdominal and back muscles slightly tense.
- We avoid complete stretching of the joints. The elbow and knee joints must be slightly bent at all times.
- Keep your wrists in an extended forearm position during the exercise.
- Push the heels towards the bottom and touch the bottom of the pool with the entire surface of your feet.
- Breathe evenly and relaxed, and do not hold your breath while performing the exercises.
- Pay attention to the correct execution of individual exercises and basic movements.
- Gradually increase the training intensity and control it.
- During exercise we drink several times to regularly replace the lost fluid.
- During exercises and movements, we flex the foot upwards (dorsal flexion), especially if we tend to have cramps in the calf muscles.
- Keep the body stable during backward movements.
- Use aids safely, correctly and efficiently.

### **6.2.3. Dangerous movements and contraindicated exercises**

Some movements and the resulting exercises can be dangerous if they have a higher number of repetitions. These are often exercises that have been used frequently in the past. Based on research, the profession eventually concluded that their disadvantages outweigh the advantages they bring. Such exercises should be omitted from the training program and thus avoid the risk of injury or adapt them with many other safe variations. We pay particular attention to all movements that jeopardise the trainee's correct body posture, the safety of the spine and lower back.



Dangerous movements and contraindicated exercises (Pappas Gaines, 1993; Rodriguez Adami, 2004; Sanders, 1993):

- Exercises where we rest our upper limbs on the edge of the pool. Even if we press our back against the wall, the shoulder, elbow and wrist joints are subjected to a great deal of stress, which does not outweigh the positive effects of exercises for the abdominal muscles and lower body.
- High-rebound movements where most of the body comes out of the water. The stress on the joint system is so great in such movements that the benefits of exercising in water are negated. During kicking movements, the upper body can only rise out of the water up to the level of the navel.
- Movements performed at high speed that mimic the speed of execution on land. The pressure on the joints is high due to the increased water resistance, it is difficult to maintain correct posture and balance, the amplitude of movement is low and the effect of the exercise is limited.
- Exercises where we break the surface of the water and move our upper limbs alternately in and out of the water. By repeatedly overcoming the tension created at the water surface and due to the large difference in resistance between water and air, damage to shoulder and elbow joints can occur. In addition, such exercises are quite uncomfortable for the patients due to the accompanying splashing.
- Prolonged movements of the upper limbs above the head. As they increase blood pressure, they are contraindicated, especially for people who already have problems with high blood pressure. With them we do not exploit the aquatic environment.
- Exercises involving sudden rotations of the trunk, large amplitudes of rotation or simultaneous forward tilt of the trunk and twisting of the trunk (touching the elbow and opposite knee). The safety of the spine is at risk.
- Push-ups with support at the front or back of the pool edge by lifting the body out of the water. Due to the complexity of performing the exercise correctly and the often insufficient strength of the muscles involved, overstretching of the elbow joint, hunched shoulders, wrist pain and slipping off the support are common.
- Upper body flexion with legs raised at the edge of the pool. The effectiveness of the exercise is low, the front hip muscles are more involved and the abdominal muscles less, the neck and spine are in an incorrect position.
- Crawl kick (kicking) while lying down with a grip on the edge of the pool. Students often have great difficulty maintaining an extended chest position on the water surface. Common faults are: folded arms, legs sunk in too much, greater curvature of the lumbar spine, neck, shoulder and back muscles not relaxed.
- Stretching the rear thigh muscles in a forward bend while standing with one leg against the pool wall. The lumbar spine is overloaded.

### **6.3. Exercise injuries**

Injuries rarely occur during training in the water. The danger is mainly slips on slippery swimming surfaces, muscle cramps, fear of losing balance in poor swimmers and collisions between patients when changing direction frequently or when the number of patients exceeds the capacity of the pool, and various abrasions. Abrasions to the palms of the hands can be caused by grabbing a damaged steel mesh



of the course or a damaged float when the course is used to delineate the water surface in the training programme. Abrasions to the feet can be caused by a damaged ceramic tile – missing, raised or cracked glaze. Pools are heavily used and are greatly affected by equipment wear and tear. It is important to recognise the danger spots and point them out to the pool staff in charge.

If the exercise takes place without the presence of a lifeguard, the instructor must intervene in case of any injuries, otherwise he calls the lifeguard. Taking into account preventive safety recommendations, the basic principles of safe exercise and the avoidance of contraindicated exercises, the risk of injury is significantly lower.

People are increasingly aware that physical exercise has a positive impact on maintaining and improving health. It must be regular, controlled and adapted to the individual's health condition. The instructor must be aware that it is difficult to completely rule out the presence of chronic diseases in participants of aquatic exercise programs. That is why he must advise patients/exercisers, especially those who have chronic illnesses, to consult with a doctor before joining an exercise program or undergo a medical examination with stress testing of physical fitness. The instructor must be aware of their state of health. Based on this, he must adjust the exercise program for the sick person and know how to respond appropriately to health-risk groups, he must be additionally professionally qualified for this and compile the exercise program in cooperation with health experts.

#### **6.4. Contraindications**

It is recommended that, before starting any physical activity, the trainee should consult with his/her personal doctor about their health condition and undergo a medical examination.

Although for most people, physical activity does not pose health risks, but rather preventive and improves the quality of life, the instructor must be before starting the exercise aware of the health condition and possible diseases of the patients, which require quick and specific action. Therefore, upon inclusion in the exercise program, all participants of aquatic aerobics receive a questionnaire on fitness for physical activity, and pregnant women and seniors a health questionnaire.

Those who have acute illnesses should not exercise in the water. In the case of chronic diseases, the patients must first consult with a doctor. We must be especially careful if any of the absolute or relative contraindications mentioned below appear (Backović Jurčan, 2005; Mišigoj – Duraković et al., 2003),

##### **Absolute contraindications are:**

- Serious heart diseases (e.g., new onset angina pectoris or worsening of the existing one, appearance of heart arrhythmia during exertion despite taking medication, recent myocardial infarct, clear clinical signs of heart failure or angina pectoris during activity less than 4 MET),
- High blood pressure during exertion (RR systolic > 250 mm Hg and RR diastolic > 120 mm Hg),
- Serious kidney diseases,
- Infectious diseases (e.g., flu and viral diseases, tuberculosis, hepatitis C),
- Acute inflammatory conditions (e.g., nerves, blood vessels, joints, muscles, veins, skin),
- Active infectious diseases,
- Involuntary leakage of urine and stool,
- Recently suffered a stroke,
- Increased body temperature,



- Open wounds, and
- Severe dizziness and/or lightheadedness and/or nausea

**Relative contraindications** are:

- Uncontrolled diabetes,
- Poorly controlled thyroid diseases,
- Poorly controlled epilepsy,
- Disturbed functioning of the adrenal gland,
- Irregular respiratory diseases (e.g., chronic obstructive pulmonary disease, asthma),
- Arthritis in an acute state,
- Poorly controlled blood pressure,
- Severe anaemia, and
- Headache.

**Restrictions of exercise in water include:**

- Neurological diseases,
- Peripheral vascular diseases,
- Fear of water,
- Fast-onset fatigue,
- Allergy to chlorine,
- Vital capacity less than 1000 ml, and
- Wrinkling of the skin due to staying in water for too long.

## **7. ASSESSMENT OF THE HEALTH STATUS OF POST-COVID PATIENTS AND THE LEVEL OF MOTOR SKILLS**

In order to determine the health status of the post-COVID patients, questionnaires are used, and their motor skills are assessed using tests.

### **7.2. QUESTIONNAIRES FOR POST-COVID PATIENTS**

- General post-COVID questionnaire
- Multidimensional fatigue inventory questionnaire
- Quality of life questionnaire (EQ-5D-5L)
- Food frequency questionnaire (FFQ) - Measurements of food intake (energy and nutrients), which the study does not change, namely through a standardized food questionnaire (Clarys et al., 2014; De Keyzer et al., 2013), which we have used several times on the Slovenian population (Jakše, Jakše, Fidler Mis, et al., 2021; Jakše, Jakše, Godnov, & Pinter, 2021; Jakše, Lipošek, Zenić, & Šajber, 2022) (in attachment).



## 8. TESTS OF MOTOR ABILITY



Figure 4. Picture of test environment

### 8.2. Assessment of aerobic abilities

*a) 6 Minute Walk Test*

*b) 2 Minute Walk Test in place (for senior patients)*

With the walk test, we primarily test aerobic capacity (cardiac, vascular and respiratory capacity). We recommend that you always perform the test under supervision. You participate in the test at your own risk.

Before testing, it is necessary to fill out the questionnaire:

#### ASSESSMENT OF SUITABILITY FOR PHYSICAL ABILITY TESTING

NAME: \_\_\_\_\_ SURNAME: \_\_\_\_\_ AGE: \_\_\_\_\_ (year)

BODY HEIGHT: \_\_\_\_\_(cm) BODY MASS: \_\_\_\_\_ (kg) BMI: \_\_\_\_\_ (kg/m<sup>2</sup> )

<https://sitis.si/itm-kalkulator-izracunaj-svoj-indeks-telesne-mase/>

BLOOD PRESSURE: \_\_\_\_\_ (mmHg) AND/OR HEART RATE: \_\_\_\_\_

DATE: \_\_\_\_\_





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**EVALUATION OF SUITABILITY FOR TESTING** Answer all questions!

- |  |     |    |
|--|-----|----|
| 1. Do you have a congenital heart defect or disease?                         | YES | NO |
| 2. Do you have painful, swollen or inflamed joints?                          | YES | NO |
| 3. Do you feel a burning pain while walking, pain or pressure in your chest? | YES | NO |
| 4. Do you sometimes feel dizzy or light-headed when walking?                 | YES | NO |
| 5. Are you extremely tired?  | YES | NO |
| 6. Do you have a fever?  | YES | NO |
| 7. Are you taking medication? Which?   | YES | NO |
| 8. Have you been sick recently (in the last 3 months)?                       | YES | NO |

If you answered “NO” to all questions, you can take the test without hesitation. If you answered “YES” to one or more questions, please contact the test administrator.

SIGNATURE: \_\_\_\_\_

With my signature, I hereby confirm the accuracy of the information provided and at the same time authorize the test organizer to use my data for scientific purposes.

**6 MINUTE WALK TEST** – assessment of aerobic endurance

The 6 Minute Walk Test is suitable for people aged 18–65 years, with various chronic conditions and/or overweight. Before the test, the participant of the workshop should fill out the form Assessment of fitness for physical capacity testing (below). To enter the results, use the form Test card for the 6-minute walk test:



### TEST CARD FOR THE 6 MINUTE WALK TEST

Name and surname: \_\_\_\_\_ Date of testing: \_\_\_\_\_

Age: \_\_\_\_\_ years

Height: \_\_\_\_\_ cm

Mass: \_\_\_\_\_ kg

**Walk as fast as you can for 6 minutes. Your goal should be to cover as much distance as possible. Pay attention, that at the marking, you turn as quickly as possible and without stopping.**

After each completed round, mark with a line the number of completed rounds in the table prepared below. One line represents 30 meters walked.

III 5   III 10   III 15   III 20   III 25   III 30   III 35

Distance travelled of the last lap: \_\_\_\_\_ m.

Distance travelled: \_\_\_\_\_ m.

NOTES:

Heart rate: \_\_\_\_\_ \_\_\_\_\_ beats/minute

Physical performance category (circle in):

**Below average**

**Average**

**Above average**

Figure 5. Test card of the Six Minute Walk Test

- **Equipment:** Trundle wheel for measuring the distance, self-adhesive coloured tape, 2 stop watches, 4 cones, coloured marker, test cards for the 6-minute walk test, pocket computer, heart rate monitors.

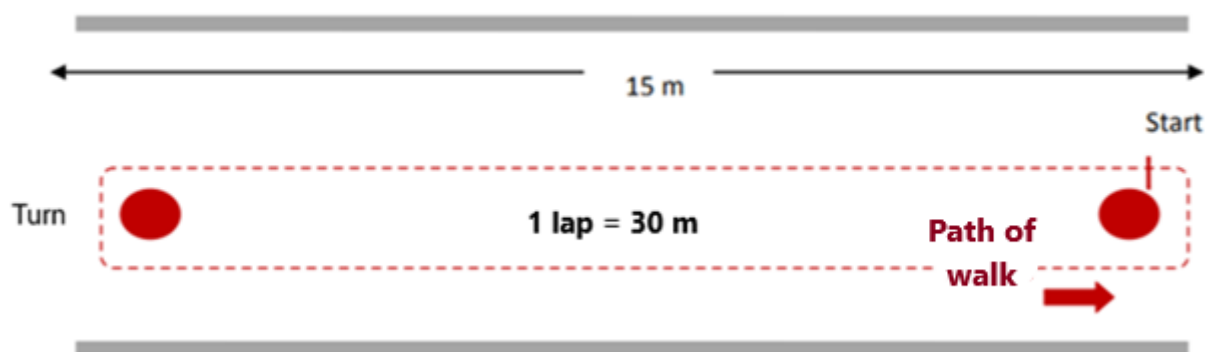


Figure 6. Schematic illustration of the 6 Minute Walk Test.

### Procedure:

Divide the test subjects into pairs, with one subject doing the test and the other counting the laps (after each walked lap, they record the number of laps on the test card for the 6-minute walk test). Demonstrate the completed lap, pay special attention to demonstrate the turning at the mark, it should be done as quickly as possible and without stopping. Walk briskly, but do not run. Individual subjects should start every 10 seconds. When given the command “Now,” the subjects are asked to walk as fast as possible for 6 minutes. Encourage subjects after each minute. Ask them about their heart rate (to make sure the monitors are working properly) and inform them of the remaining test time. At 1 minute tell them: You are doing well. You have 5 minutes to go. At 2nd minute say: check your heart rate. Keep up the good work. You have 4 minutes to go. At 3rd minute say: You are doing well. You are halfway done. At 4th minute tell: Check your heart rate. Keep up the good work. You have only 2 minutes left. At 5th minute say: You are doing well. You have only 1 minute to go. At 15 seconds before the end of the test, say: The test is over at any time. At 6th minute say: Please stop where you are.

After 6 minutes, stop each subject individually. Walk quickly towards the subject and read the heart rate value. Also read (from the marker closest to the subject) the distance travelled in the last lap. If the subject stops before the 6 minutes are up and is no longer able to complete the test, the examiner at the end notes the time and distance covered and the reason for not completing the test.

### Instructions to the assistant:

Record each lap completed, when the test subject walks past you. Do not walk along the track or speak to the test subject. Stand by the finish line.

- Result: The final result of the test is the product of the total number of laps completed and the distance of one lap in meters (30 m) and the addition of the distance covered on the last lap (for the reading, consider the mark on the ground/wall closest to the subject).

### Example:

If the subject walks 24 laps and an additional 18 meters, the test result is:  $(24 \times 30) + 18 = 738$  m



### Instructions to the test subjects:

Divide the subjects into pairs. Walk as fast as you can for 6 minutes (don't run). Your goal should be to cover as much distance as possible. Be sure to turn around as quickly as possible without stopping. Watch my demonstration (demonstration of turning at marking) carefully. We will warn you after every minute so you can assess how you are feeling. If you can't run continuously, that's not a problem. If you want to rest during the test, stop, rest, and then continue.

### Evaluation of test results 6 Minute Walk Test – men

Age	Below average	Average	Above average
18-29	≤ 655	656-699	≥ 700
30-39	≤ 630	631-694	≥ 695
40-49	≤ 630	631-694	≥ 695
50-59	≤ 605	606-674	≥ 675
60-69	≤ 605	566-634	≥ 635
≥ 70	≤ 505	506-569	≥ 570

Table 3. Table of test results of the 6 Minute Walk Test for men.

### Evaluation of test results 6 Minute Walk Test – women

Age	Below average	Average	Above average
18-29	≤ 605	606-660	≥ 661
30-39	≤ 600	601-655	≥ 656
40-49	≤ 590	591-645	≥ 646
50-59	≤ 565	566-615	≥ 616
60-69	≤ 525	526-575	≥ 576
≥ 70	≤ 465	466-515	≥ 516

Table 4. Table of test results of the 6 Minute Walk Test for women.



## *2 MINUTE WALK ON THE SPOT TEST – Assessment of aerobic endurance for seniors*

The 2 Minute Walk Test is suitable for people aged 65 and over, as well as chronic patients under 65 who are less physically fit. Before the test, the participant of the workshop should fill out the form Assessing suitability for physical capacity testing (see below). To enter the results, use the form Test card for the 2 Minute Walk Test.

### **Evaluation of test results**

#### **2 Minute Walk Test – men**

<b>Age</b>	<b>Below average</b>	<b>Average</b>	<b>Above average</b>
60-64	≤ 87	87-115	≥ 115
65-69	≤ 87	86-116	≥ 116
70-74	≤ 80	80-110	≥ 110
75-79	≤ 73	73-109	≥ 109
80-84	≤ 71	71-103	≥ 103
85-99	≤ 59	59-91	≥ 91
90-94	≤ 52	52-86	≥ 86

*Table 5. Table of test results of the 2 Minute Walk Test for men.*

#### **2 Minute Walk Test – women**

<b>Age</b>	<b>Below average</b>	<b>Average</b>	<b>Above average</b>
60-64	≤ 75	87-115	≥ 107
65-69	≤ 73	86-116	≥ 107
70-74	≤ 68	80-110	≥ 101
75-79	≤ 68	73-109	≥ 100
80-84	≤ 60	71-103	≥ 91
85-99	≤ 55	59-91	≥ 85
90-94	≤ 44	52-86	≥ 72

*Table 6. Table of test results of the 2 Minute Walk Test for women.*



- **Equipment:** coloured tape or string, chronometer.

- **Procedure:**

The subject stands next to the wall, on which we mark the height between the patella and the intestinal ridge. The subject will walk in place for two minutes, so that the knee will always reach the marked height. Intermittent rest and support with one hand on a wall or chair are permitted.



*Figure 7. Scheme and picture of the correct performance of the 2 Minute Walk Test in place*

- **Instructions to the subject:**

As you step in place, lift your knees high enough to touch the string. With each step you must touch the ground with your entire sole. You step in place and do not run. The examiner will notify you every 30 seconds so you can assess how you are feeling. If you can't walk for two minutes, that's no problem. Try to walk as long as possible. If you want to rest during the test, stop, rest, and then continue.

- **Result:** The number of lifts of the right knee to the indicated height.



TEST CARD FOR TWO MINUTE WALK TEST

Name and surname: \_\_\_\_\_ Date of testing:  
\_\_\_\_\_

Age: \_\_\_\_\_ years

Height: \_\_\_\_\_ cm

Mass: \_\_\_\_\_ kg

**Walk as fast as you can for 2 minutes, raising your knees high.  
Be careful to always touch the marked height with your knee.**

Number of right knee lifts: \_\_\_\_\_

Category of body capacity (circle in):

**Below average**

**Average**

**Above average**

NOTES:

*Figure 8. Test card for Two Minute Walk Test*

### 8.2.1. Assessment of flexibility



Figure 9. Picture of seated forward bend

The seated forward bend is a measurement task that measures the length of the trunk's forward lean to demonstrate adequate mobility. The seated bending over test (SLOFIT test) requires a specially designed bench for measuring arm reach. Mobility is important for safely performing large-amplitude movements. We assess the mobility of the legs and the lower part of the spine while sitting forward. Low values indicate a too short hamstring, which results in an increased risk of injury during various leg movements and the inability to perform a full range of leg movement, as well as reduced mobility of the lower spine. At the same time, a low score may be an indicator of exposure to increased stress, which increases muscle tone.

### 8.2.2. Tests of muscle power and strength

#### 8.2.2.1. Measuring hand grip strength with a hand dynamometer (SLOFIT)

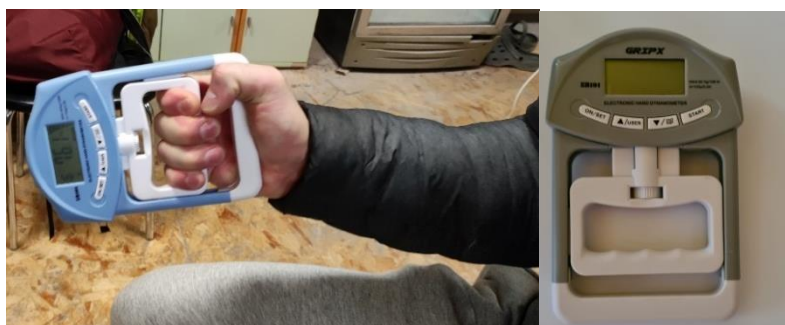


Figure 10. Measuring hand grip strength with a hand dynamometer

Hand grip strength is used in a complete assessment of the patient's physical condition. Hand grip strength testing is a popular assessment used by therapists in a variety of clinical settings. It is fast, easy to perform, reliable and gives a result that is easy to record. The purpose of test is to measure maximum isometric strength of hand and forearm muscles. Hand grip strength assessment can be used as a test to quickly indicate one's general muscle strength (Wind, A.E., Takken, T., Helders, P. J., & Engelbert, R. H., 2010)





## Test protocol

1. The subject should be in a standing position. The test is performed to assess the strength of the dominant hand.
2. Position the dynamometer so that the other joint of the fingers is bent in order to grasp the dumbbell.
3. The subject should hold the dynamometer parallel to the body. The elbow should be bent at an angle of 90°, and before the measurement it should be checked whether the dynamometer is zeroed.
4. After placing in the correct position, the subject should squeeze the dumbbell of the dynamometer as hard as possible without holding his breath (to avoid the so-called Valsalva manoeuvre). It is possible for the subject to extend his elbow if that position suits him better, but he should avoid a compensatory movement in some other part of the body.
5. Record the value displayed on the dynamometer in kilograms, and repeat this procedure two more times.
6. Take the highest value of all three recorded results for each trial.

## REFERENCE VALUES

Male (Age)	Needs improvement	Fair	Good	Very Good	Excellent
15-19	< 84	84-94	95-102	103-112	>112
20-29	< 97	97-105	106-112	113-123	>123
30-39	< 97	97-104	105-112	113-122	>122
40-49	< 94	94-101	102-109	110-118	>118
50-59	< 87	87-95	96-101	102-109	>109
60-69	< 79	79-85	86-92	93-101	>101

Table 7. Table of reference values for men



Female (Age)	Needs improvement	Fair	Good	Very Good	Excellent
15-19	< 54	54-58	59-63	64-70	>70
20-29	< 55	55-60	61-64	65-70	>70
30-39	< 56	56-60	1-65	66-72	>72
40-49	< 55	56-58	59-64	65-72	>72
50-59	< 51	51-54	55-58	59-64	>64
60-69	< 49	48-50	51-63	54-69	>69

Table 8. Table of reference values for women

### 8.2.3. Test getting up the chair in 30sec (SLOFIT)

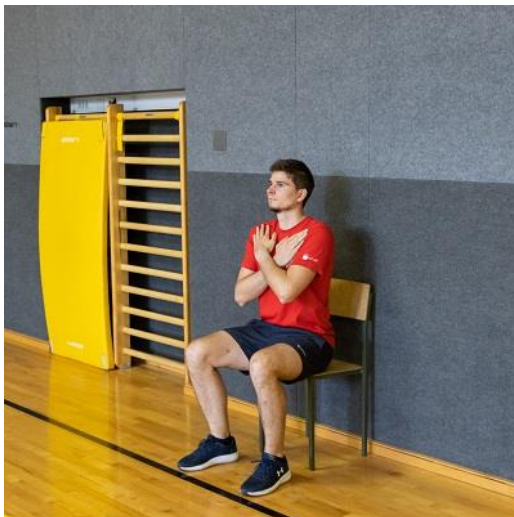


Figure 11. Picture of test getting up the chair

The result is the number of times you get up from a chair in 30 seconds. The measuring task of getting up from a chair measures the capacity and endurance of the leg muscles, especially the front muscles of the upper leg. In addition to leg strength, the task also assesses body functionality and muscle activity. Strength, endurance and muscle activation decrease with age, so the success of the task depends on age and body weight.



#### 8.2.4. Abdominal muscle strength (SLOFIT)



Figure 12. Picture of abdominal muscle strength

The number of correctly performed trunk bends in the prescribed rhythm is measured for a period of 30 seconds. The trunk flexion measurement task is used to assess endurance in trunk and hip flexor strength. Such well-developed muscular endurance is important for injury prevention, as it enables proper body posture, lower spine health, and overall body function.

*Source: Slofit instructions*

The measurer sticks two one-meter-long adhesive tapes 10 cm apart on the pillow, and sets the metronome to a frequency of 50 beats/minute. The test subject lies on his back, arms extended along the body, palms facing the floor and fingers extended. The tips of the longest fingers of both hands are aligned with the first band. His knees are bent at about a 90° angle and his feet are flat on the floor. The subject performs the task by exhaling to activate the trunk flexors and raise the head and upper back to the lower edge of the shoulder blades. The arms remain stretched and the palms slide over the floor to the second tape. He touches the second tape with the fingertips of both palms and lets himself fall back to the floor with an inhale. Palms, buttocks and feet must remain on the floor throughout the entire performance. Tries before the test are not permitted. The subject performs partial flexions of the upper body as dictated by the metronome, i.e. with the first beat of the metronome the upper body rises/bends, with the next beat it lowers and so on. Instructions for the subject: “Start lying on your back with your arms extended along your body, palms facing the floor and fingers extended.” In this position, the tips



of the longest fingers should touch the first tape. You perform partial trunk bends to the rhythm of the metronome: On the first beat, as you exhale, lift your head and upper back and at the same time slide with your arms still stretched to the second tape. On the next metronome beat, you return to the starting position as you inhale. Your abdominal muscles should be active all the time (when lifting and lowering) and the lumbar part should be gently pressed to the floor. Your task is to perform as many of these trunk bends as possible in two minutes at the speed described. The execution must be smooth, without jerks and fluctuations. Do not hold your breath during the test.”

Before carrying out the measuring task, the measurer demonstrates the correct execution. The measurer monitors and counts correctly performed partial flexions of the trunk within two minutes. In the event that the test subject is no longer able to maintain the prescribed speed when performing flexions (no longer being able to follow the rhythm of the metronome), the measurement task is interrupted and the number of partial flexions that have been correctly performed up to that point is recorded. If the subject performs the task for 120 seconds, the execution of the task is interrupted and the maximum possible result is recorded, i.e., 50 partial trunk bends.

## 8.2.5. Balance test

### 8.2.5.1. Y-Balance Test (YBT)

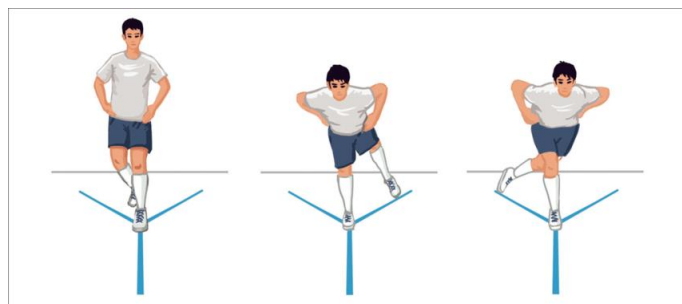


Figure 13. Scheme of Y-Balance Test

The test serves to measure dynamic balance in a closed kinetic chain. The test is performed so that the subject has the task of standing on one leg as far as possible with the other leg forward (anterior), back left and right (posterolateral and posteromedial), along the measuring tape that is stuck on the floor. This test measures strength, stability and balance in different directions. The YBT composite score is calculated by summing the 3 reach directions and normalizing the score to leg length, while the asymmetry score is the difference between right and left leg reach.



The test should be performed in the following order:

1. Right forward
2. Left forward
3. Right posteromedial
4. Left posteromedial
5. Right posterolateral
6. Left posterolateral

With the hands firmly placed on the hips, the subject should be instructed to reach forward with the right leg as far as possible and return to the starting upright position.

Reach distances should be recorded to the nearest 0.5 cm.

They should then repeat this with the same leg for a total of 3 successful reaches. After performing 3 successful procedures with the right leg, they were allowed to repeat this procedure with the left leg.

After the subject has performed 3 successful reaches with each leg, he can progress to the next test direction (i.e., posteromedial).

The test administrator should record the reach distance of each attempt to calculate the athlete's YBT composite score.

### Example of a test form

**Lower Quarter Y-Balance Test:** Right LE K Limb Length: \_\_\_\_ cm (Distal ASIS to Distal Medial Malleolus)

Direction	Right Trial 1	Right Trial 2	Right Trial 3	Left Trial 1	Left Trial 2	Left Trial 3

Direction	Greatest Right	Greatest Left
Anterior		
Posteromedial		
Posterolateral		

Figure 14. Example of test form of Y-Balance Test

### **Test failed:**

The subject cannot touch the foot on the floor before returning to the starting position. Any loss of balance will result in a failed attempt. However, after returning to the starting position, they are allowed to place the leg behind the centre/balance position of the leg.

### **Scoring system**

With the test completed and all performances recorded, the test administrator can calculate the subject's YBT performance scores using any or all of the following three equations:

Absolute reach distance (cm) = (Reach 1 + Reach 2 + Reach 3) / 3

Relative (normalized) reach distance (%) = absolute reach distance / limb length \* 100

Total reach distance (%) = sum of 3 reach directions / 3 times limb length \* 100



The test has been proven to have high reliability even in older subjects. (Sipe, C. L., Ramey, K. D., Plisky, P. P., & Taylor, J. D. (2019). Y-Balance Test: A Valid and Reliable Assessment in Older Adults. Journal of aging and physical activity, 27(5), 663–669. <https://doi.org/10.1123/japa.2018-0330>)

### 8.2.5.2. Stork Test

The test involves standing on the toes of 1 leg in the "stork" position. The stance involves keeping your hands on your hips and placing the foot of the leg that is not on the ground on the inside of the knee of the standing leg. The subject can practice maintaining balance for 1 minute, after which the test can be performed. It rises on the toes of the standing leg and maintains balance. Timing is stopped if: if the hands or arms move away from the hips, if the standing leg moves in any direction, if the leg that is not on the floor loses contact with the knee, or if the heel of the standing leg touches the floor.

Evaluation	Result (seconds)
Excellent	>50
Very good	40 - 50
Average	25 – 39
Below average	10 - 24
Bad	<10

Table 9. Evaluation of Stork Test

### 8.3. Tests in water

The first picture shows a test performed in shallow water (up to the chest). And the second picture shows a test performed on dry land for assessment of cardiorespiratory endurance.

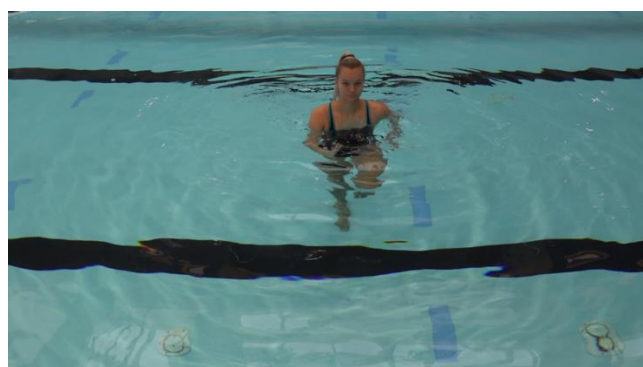


Figure 15. Test performed in shallow water



Figure 16. Test performed on dry land

Jogging on the spot, front kick and cross country ski exercises are used (it is suggested that we choose only one – jogging on the spot). The exercise is divided into two phases, and each segmental action (flexion or extension of the hip) is performed during one beat of the metronome. Jogging on the spot is



an exercise performed with one support and a swing phase. In the first phase, the right hip and knee flex up to 90°; the second phase corresponds to the extension of the right hip and knee. The left lower extremity performs the opposite movement in each phase, thus maintaining alternating performance. In addition, the upper limbs perform an alternating movement of shoulder semiflexion and subsequent extension with the elbow flexed to 90° to maintain balance during the exercises. For each subject, the limit of 90° required for flexion is determined with an elastic band in the pool, in order to The maximum incremental test in shallow water is performed with an initial cadence of 80 b·min<sup>-1</sup> for 2 min, with an increase of 10 b·min<sup>-1</sup> in a cadence of every minute until maximum effort is reached. Previous studies used a digital metronome (MA-30 KORG), a mobile metronome can also be used over a speaker so that subjects can better hear the beats.

The result of the test is the time that the subjects were able to endure while performing exercises in the water. Aquatic aerobic exercise protocols are performed in a shallow pool between 0.95 and 1.30 m deep, with subjects immersed to a depth between the xiphoid process (while standing) and the shoulder (while exercising). The water temperature is 31-32 degrees. The tests are stopped when the subjects show their exhaustion with a hand sign or when they can no longer keep up with the rhythm. *Alberton, C. L., Pinto, S. S., Gorski, T., Antunes, A. H., Finatto, P., Cadore, E. L., Bergamin, M., & Kruei, L. F. (2016). Rating of perceived exertion in maximal incremental tests during head-out water-based aerobic exercises. Journal of sports sciences, 34(18), 1691–1698. <https://doi.org/10.1080/02640414.2015.1134804>*

Subjects report their degree of fatigue after the test: Borg 6–20 rating of perceived exertion (RPE) scale for measuring RPE. The 15-point scale includes nine verbal descriptors ranging from "no exertion" (RPE 6) to "maximum exertion" (RPE 20). A score of 6 corresponds to the level of exertion experienced during quiet sitting, while a score of 19 is close to maximal or near maximal physical exertion. Suggestion: after each "degree" ask the subject what the effort is, if it is 15 or more, we stop the test and record it as the maximum.

Borg's Rating of Perceived Exertion (RPE) Scale	
Perceived Exertion Rating	Description of Exertion
6	No exertion; sitting and resting
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

BORG RATING OF PERCEIVED EXERTION SCALE	
Numerical value	Descriptive value
6	no exertion at all, relaxed
7-8	extremely light
9-10	very light
11	light
12-13	moderate
14-15	hard
16-17	very hard
18-19	extremely hard
20	maximal exertion

Figure 17. BORG scale



### 8.3.1. Protocol of initial testing of participants of the post-COVID swim project

#### 1. Questionnaires

- PostCOVID swim general survey
- Multidimensional fatigue inventory (MFI)
- EQ-5D-5L – questionnaire for assessing the quality of life
- Questionnaire of eating habits

#### 2. Anthropometric measurements and health status

- Body height
- Body weight
- Body mass index
- Waist circumference
- Body composition: Skin folds (triceps and calf)/Tanita bio impedance to estimate the percentage of fat tissue
- Blood oxygen saturation (pulse oximeter)
- Blood pressure and pulse



Figure 18. Picture of performing of the protocol

#### 3. Aerobic abilities

- 6-minute walking test
- 2-minute walking test in place (for elderly patients)

#### 4. Muscle strength and power

- The strength of the fist grip
- Test of getting up from a chair in 30 seconds
- Abdominal muscle strength test





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## 5. Balance

- Y-balance test
- Roda test

## 6. Tests in water

- Jogging on the spot test - incremental maximum load test

## TEST FORM (private)



DATE OF TESTING:

NAME AND SURNAME	
DATE OF BIRTH	
HEIGHT	
BODY MASS	
WAIST	
PULS	
PRESSURE	
O2	
6-MIN WALK	
2-MIN WALK	
SIT AND REACH	
HANDGRIP	
SEAT 30s	
ABS	
Y BALANCE TEST	
ANTERIOR R	
ANTERIOR L	
POSTEROMEDIAL R	
POSTEROMEDIAL L	
POSTEROLATERAL R	
POSTEROLATERAL L	
ANTERIOR R	
WATER TEST	
WATER (MIN)	
WATER (BORG)	

Figure 19. Test form of the BORG test



## 1. Table Displaying an Exercise Plan and Program

1. Functional (general) state of the body - diagnosis (doctor's report)	2. Selection of exercises (depending on the level of swimming knowledge)	3. Exercise Volume (Numerical Values)	4. Exercise intensity (indexation - numerical values)	5. Note (limiting factors in exercise selection and load size (volume and intensity))
poor aerobic abilities (VO <sub>2</sub> peak)	breathing exercises in a standing position  breathing exercises in a lying position	15-30 min during the first few weeks; 2-3 training/week	30%-60% of maximal inspiratory pressure	non-swimmers/recreational swimmers/swimmers; volume and intensity are adjusted to aerobic capacity
poor aerobic ability (VO <sub>2</sub> peak)/good aerobic ability (VO <sub>2</sub> peak)	breathing exercises while submerging the head in water	15-30 min during the first few weeks; 2-3 training/week	30%-60% of maximal inspiratory pressure	non-swimmers/recreational swimmers/swimmers; volume and intensity are adjusted to aerobic capacity
poor aerobic abilities (VO <sub>2</sub> peak)	walking in a small-sized pool	15-30 minutes during the first few weeks and can then be cautiously up-titrated to 30-60 min/d; 1-3 sets of 3-5 min at moderate intensity; 2-3 training/week	maintaining a heart rate reserve of 40%-59% during exercise or <40% of VO <sub>2</sub> peak during the first few weeks and can then be cautiously up-titrated to 50-70% VO <sub>2</sub> peak; ≥70% according to patients' progress during exercise training and individual preference	non-swimmers/recreational swimmers/swimmers; volume and intensity are adjusted to aerobic capacity



1. Functional (general) state of the body - diagnosis (doctor's report)	2. Selection of exercises (depending on the level of swimming knowledge)	3. Exercise Volume (Numerical Values)	4. Exercise intensity (indexation - numerical values)	5. Note (limiting factors in exercise selection and load size (volume and intensity))
poor aerobic ability (VO <sub>2</sub> peak)/good aerobic ability (VO <sub>2</sub> peak)	1. STEPPING ON THE SPOT	15-30 minutes during the first few weeks and can then be cautiously up-titrated to 30-60 min/d; 1-3 sets of 15-20 repetitions at moderate intensity; 2-3 training/week	maintaining a heart rate reserve of 40%-59% during exercise or <40% of VO <sub>2</sub> peak during the first few weeks and can then be cautiously up-titrated to 50-70% VO <sub>2</sub> peak	non-swimmers/recreational swimmers/swimmers; volume and intensity are adjusted to aerobic capacity
poor aerobic ability (VO <sub>2</sub> peak)/good aerobic ability (VO <sub>2</sub> peak)	FROM EXERCISE 2 TO EXERCISE 114 (script)	15-30 minutes during the first few weeks and can then be cautiously up-titrated to 30-60 min/d; 1-3 sets of 15-20 repetitions at moderate intensity; 2-3 training/week	maintaining a heart rate reserve of 40%-59% during exercise or <40% of VO <sub>2</sub> peak during the first few weeks and can then be cautiously up-titrated to 50-70% VO <sub>2</sub> peak; ≥70% according to patients' progress during exercise training and individual preference	non-swimmers/recreational swimmers/swimmers; volume and intensity are adjusted to aerobic capacity
poor aerobic ability (VO <sub>2</sub> peak)/good aerobic ability (VO <sub>2</sub> peak)	Jogging in a medium-sized pool	15-30 minutes during the first few weeks and can then be cautiously up-titrated to 30-60 min/d; 1-3 sets of 3-5 min at moderate intensity; 2-3 training/week	maintaining a heart rate reserve of 40%-59% during exercise or <40% of VO <sub>2</sub> peak during the first few weeks and can then be cautiously up-titrated to 50-70% VO <sub>2</sub> peak; ≥70% according to patients' progress during exercise training and individual preference	non-swimmers/recreational swimmers/swimmers; volume and intensity are adjusted to aerobic capacity



1. Functional (general) state of the body - diagnosis (doctor's report)	2. Selection of exercises (depending on the level of swimming knowledge)	3. Exercise Volume (Numerical Values)	4. Exercise intensity (indexation - numerical values)	5. Note (limiting factors in exercise selection and load size (volume and intensity))
poor aerobic ability (VO <sub>2</sub> peak)/good aerobic ability (VO <sub>2</sub> peak)	Swimming at a moderate pace	15-30 minutes during the first few weeks and can then be cautiously up-titrated to 30-60 min/d; ≥300 m; 2-3 training/week	maintaining a heart rate reserve of 40%-59% during exercise or <40% of VO <sub>2</sub> peak during the first few weeks and can then be cautiously up-titrated to 50-70% VO <sub>2</sub> peak; ≥70% according to patients' progress during exercise training and individual preference	recreational swimmers/swimmers; volume and intensity are adjusted to aerobic capacity; volume for the first few weeks should be ≤50% of pre-infection swimming volume
good aerobic abilities (VO <sub>2</sub> peak)	swimming at a moderate pace	15-30 minutes during the first few weeks and can then be cautiously up-titrated to 30-60 min/d; ≥300 m; 2-3 training/week	maintaining a heart rate reserve of 40%-59% during exercise or <40% of VO <sub>2</sub> peak during the first few weeks and can then be cautiously up-titrated to 50-70% VO <sub>2</sub> peak; ≥70% according to patients' progress during exercise training and individual preference	recreational swimmers/swimmers; volume and intensity are adjusted to aerobic capacity; volume for the first few weeks should be ≤50% of pre-infection swimming volume

Table 10. Table Displaying an Exercise Plan and Program



## 9. Breathing exercises

All breathing exercises should be done every day, in the morning, after getting up (waking up) and completing all morning rituals of personal hygiene. It is necessary to exercise for three days continuously, after which a one-day break should be taken, in the first three weeks. After that, it is necessary to exercise 5 to 6 times a week, in accordance with the possibilities of personal organization of daily duties. All exercises are performed in a standing position.

Exercises description	Method of performance
<b>Set I of exercises: Air retention exercises in the lungs with and without movement</b>	
<p>1. Inhale up to 50% of the maximum capacity (by feel) and hold the air for 20 seconds; slowly exhale air from the lungs; take a break of 30 seconds of normal breathing; repeat the exercise a total of 5 times;</p> <p>2. Inhale up to 50% of the maximum capacity (by feel) and hold the air for 10 seconds; inhale another 10-15% of additional air and hold for another 10 seconds; slowly exhale air from the lungs; take a break of 30 seconds of normal breathing; repeat the exercise a total of 5 times;</p> <p>3. Inhale up to 50% of the maximum capacity (by feel) and hold the air for 10 seconds; inhale another 10-15% of additional air and hold for another 5 seconds; inhale another 10-15% of additional air and hold for another 5 seconds; slowly exhale air from the lungs; take a break of 30 seconds of normal breathing; repeat the exercise a total of 5 times.</p>	<p><b>a)</b> Legs in a stride position, body upright, arms extended by the body (handling), exercises performed in a standing position.</p> <p><b>b)</b> With legs in a staggered stance, body upright, and hands extended by the body (handling), the mentioned exercises (I) are performed in motion, i.e., in a slow walk, during the time interval of the duration of the active part of the exercise.</p>



**Set II of exercises: Air retention exercises with and without movement**

<p>1. Inhale up to 50% of the maximum capacity (by feel) and hold the air for 20 seconds; slowly exhale air from the lungs; take a break of 30 seconds of normal breathing; repeat the exercise a total of 5 times;</p> <p>2. Inhale up to 50% of the maximum capacity (by feel) and hold the air for 10 seconds; inhale five more times using the "air swallowing" technique and hold for another 10 seconds; slowly exhale air from the lungs; take a break of 30 seconds of normal breathing; repeat the exercise a total of 5 times;</p> <p>3. Inhale up to 50% of the maximum capacity (by feel), and hold the air for 10 seconds; inhale 5 more times using the "air swallowing" technique and hold for another 5 seconds; inhale 5 more times using the "air swallowing" technique and hold for another 5 seconds; slowly exhale air from the lungs; take a break of 30 seconds of normal breathing; repeat the exercise a total of five times.</p>	<p><b>a)</b> Legs in a staggered stance, body upright, hands at your sides</p> <p><b>b)</b> With legs in a staggered stance, body upright, and arms stretched out next to the body (handling), the mentioned breathing exercises (II) are performed in motion, i.e., in slow walking during the time interval of the duration of the active part of the exercise.</p>
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**Set III of exercises: Air retention exercises in the lungs with and without movement**

<p>1. Inhale up to 70% of the maximum capacity (by feel) and hold the air for 30 seconds; intensively exhale air from the lungs; take a break of 45 seconds of normal breathing; repeat the exercise a total of 5 times;</p> <p>2. Inhale up to 70% of the maximum capacity (by feeling) and hold the air for 20 seconds; inhale another 10-15% of additional air and hold for another 10 seconds; intensively exhale air from the lungs; take a break of 45 seconds of normal breathing; repeat the exercise a total of 5 times;</p> <p>3. Inhale up to 70% of the maximum capacity (by feeling) and hold the air for 20 seconds; inhale another 10-15% of additional air and hold for another 5 seconds; inhale another 10-15% of additional air and hold for another 5 seconds; intensively exhale air from the lungs; take a break of 45 seconds of normal breathing; repeat the exercise a total of 5 times.</p>	<p><b>a)</b> Legs in a striding stance, body upright, hands extended in hand</p> <p><b>b)</b> With legs in a striding stance, body upright, arms slightly bent, and palms resting on the sides, the mentioned breathing exercises (III) are performed in movements, i.e., in a slow walk during the time interval of the active part of the exercise.</p>
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**Set IV of exercises: Air retention exercises in the lungs with and without movement**

<p>1. Inhale up to 70% of the maximum capacity (by feel) and hold the air for 30 seconds; intensively exhale air from the lungs; take a break of 45 seconds with normal breathing; repeat the exercise a total of five times.</p> <p>2. Inhale up to 70% of the maximum capacity (by feeling) and hold the air for 20 seconds; inhale five more times using the "air swallowing" technique and hold for another 10 seconds; intensively exhale air from the lungs; take a break of 45 seconds with normal breathing; repeat the exercise a total of five times;</p> <p>3. Inhale up to 70% of the maximum capacity (by feeling) and hold the air for 20 seconds; inhale five more times using the "air swallowing" technique and hold for another five seconds; inhale five more times using the "air swallowing" technique and hold for another five seconds; intensively exhale air from the lungs; take a break of 30 seconds with normal breathing; repeat the exercise a total of five times.</p>	<p><b>a)</b> Legs in a striding stance, body upright, hands extended in hand</p> <p><b>b)</b> With legs in a striding position, body upright, arms slightly bent, and palms resting on the sides, the mentioned breathing exercises (IV) are performed in movements, i.e., in a slow walk during the time interval of the active part of the exercise.</p> <p><b>c)</b> Legs in a striding position, body upright, hands in front of them, previously mentioned breathing exercises (IV) are realized in motion, i.e., in a slow walk during the time interval of the duration of the active part of the exercise;</p> <p><b>d)</b> With legs in a striding stance, body upright, arms slightly bent, and palms resting on the sides, breathing exercises (IV) are performed simultaneously by doing half-squats in a light rhythm during the time interval of the active part of the exercise.</p>
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**Set V of exercises: muscle strengthening exercises for inhalation**

<p>1. Inhale slowly 3 times in a row at about 80–85% of the maximum capacity (by feeling) and hold the air for 30 seconds; after each inhalation, remove the PBP from the mouth and exhale intensively; take a break of 60 seconds with normal breathing; repeat the exercise a total of 3 times;</p> <p>2. Take three consecutive light breaths at about 90–95% of the maximum capacity (by feeling); hold the air for 30 seconds; after each inhalation, remove the PBP from the mouth and exhale intensively. Take a break of 60 seconds with normal breathing; repeat the exercise a total of 3 times;</p> <p>3. Inhale slowly 3 times in a row with about 95–100% of the maximum capacity (according to feeling) and hold the air for 30 seconds; after each inhalation, remove the PBP from the mouth and exhale intensively; take a break of 60 seconds with normal breathing; repeat the exercise a total of 3 times.</p>	<p><b>a)</b> Legs in a striding position, body upright, arms outstretched, and POWER-breathe Plus (PBP) is in the mouth, prepared for use, and set to the first load level (<a href="https://www.powerbreathe.com/product-category/breathing-instructors/plus/">https://www.powerbreathe.com/product-category/breathing-instructors/plus/</a>)</p> <p><b>b)</b> With legs in a striding position, body upright, arms slightly bent, and palms resting on the side, repeat the previous breathing exercises (V).</p> <p><b>c)</b> With legs in a striding position, body upright, arms slightly bent, and palms resting on the sides, repeat the previous breathing exercises (V) and perform the exercises in motion, i.e., in a slow walk during the time interval of the active part of the exercise.</p> <p><b>d)</b> Legs in a staggered stance, body upright, arms in front, breathing exercises (V) are performed in motion, i.e., in a slow walk, during the time interval of the active part of the exercise.</p> <p><b>e)</b> Legs in a striding position, body upright, arms slightly bent, and palms resting on the side,</p>
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	<p>breathing exercises (V) are performed with half-squats that are performed in a light rhythm during the time interval of the active part of the exercise.</p> <p>f) Note: Every week the PBP load increases proportionally.</p>
<p><b>Set VI of exercises: Muscle strengthening exercises for inhalation</b></p>	
<p>1. Inhale up to 98-99% of the maximum capacity (by feeling), and hold the air for 10 seconds; inhale 3 more times with the "air swallowing" technique, hold the air for 5 seconds, inhale 3 more times with the "air swallowing" technique, hold the air for 5 seconds, inhale 3 more times with the "air swallowing" technique, hold the air for 5 seconds,...., and so repeat until you feel the maximum lung tension, i.e. the ability to hold air; at the end, exhale intensively until complete exhalation; with normal (intuitive) breathing, take a break of 90-120 seconds; repeat the exercise a total of 3 to 5 times; Pay special attention to the feeling of dizziness, which can occur as a side effect of exercise (in this case, it is necessary to sit down and rest for the necessary time interval).</p>	<p>a) Legs in a striding stance, body upright, arms slightly bent, and palms resting on the side</p> <div style="display: flex; justify-content: space-around;">   </div>

Table 11. Sets I to VI of breathing exercises

## 10. DETAILED DESCRIPTION OF EXERCISES

Legend:

GENERAL WARM-UP (increasing body temperature)

SPECIAL WARM-UP

AEROBIC PART (MAIN PART)

EXERCISES FOR STRENGTH

STRETCHING EXERCISES





1. **STEPPING ON THE SPOT:** Stand upright with the feet hip-width apart, raise your right knee towards the chest until your thigh is parallel to floor. Return to the starting position and perform the exercise with the left leg. Alternately lift the legs, at the same time the arms also move along the body (correct coordination), palms inside (we can turn them and thus make the movement more difficult).



2. **JOGGING ON THE SPOT:** Alternately, lift your leg and bend your knees to initiate a running phase. Hold your elbows at a 90-degree angle and move your arms in a coordinated manner (the opposite arm and opposite leg).





3. **JUMPING JACKS:** Starting from the straight upright standing position with arms at the sides and keeping your feet together, make a jump and spread your legs slightly bent, extend your arms to the sides, and then return to a position with the feet together and the arms at the sides.



4. **JOGGING ON THE SPOT WITH ALTERNATE FIST PUNCHING ACTION:** Alternately, lift and bend your knees to initiate a jogging phase. The arms alternate between the forward bent and forward outstretched position, the palms clenching into fists.





5. **STEPPING ON THE SPOT WITH ARM SWINGS IN A FIGURE OF EIGHT NEXT TO THE BODY:** Lift the legs alternately, with the left standing leg extended and the right foreleg bent. The arms are lowered and circle around at the side of your body in a figure eight motion.



6. **TOE TOUCHES:** The left leg is extended while you lift the right leg, bend the foot and is placed in front of the front leg. The opposite (left) palm is used to touch the foot. Then raise the left leg and bend it in front of the front leg, touch the foot with the opposite (right) palm. Alternatingly, lift your legs and touch your feet with the opposite palms.





7. **BACK HEEL KICK, ON THE SPOT:** The left leg is extended, while the right leg is bent back towards the buttock. Alternately, change the legs.

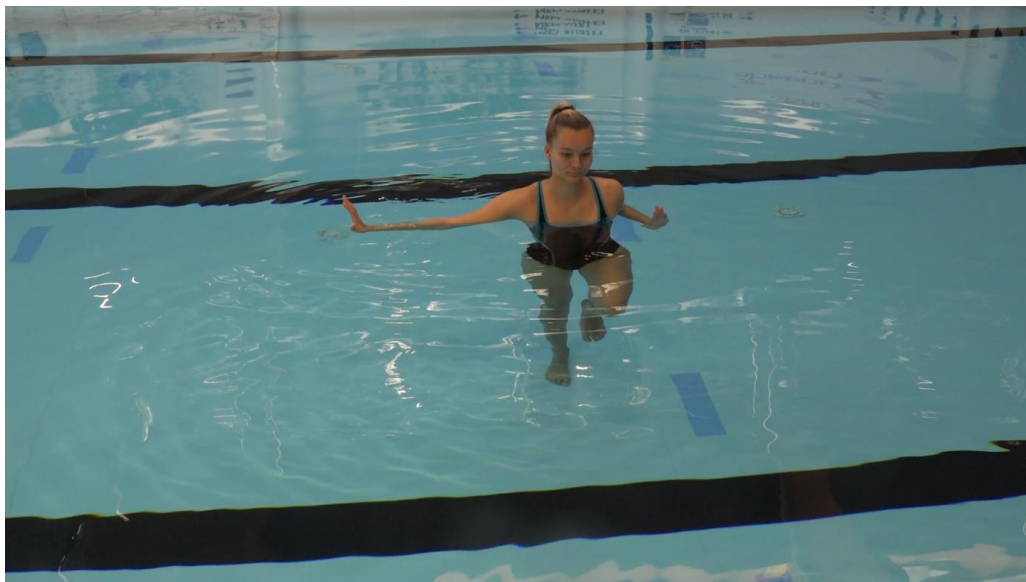


8. **STEPPING ON THE SPOT, ALTERNATELY PUSHING THE WATER FORWARD WITH THE HANDS:** The left leg is extended, right foreleg is bent, alternately raise the legs. Alternately, the hands push water from a bent position to an extended hand (palm facing away from the body).





9. **STEPPING ON THE SPOT, ALTERNATELY PUSHING WATER OUT WITH THE HANDS TO THE SIDE:** The left leg is extended, right foreleg is bent, alternately raise the legs. Alternately, the hands push water from a bent position to an extended hand to the side (palms facing away from the body).



10. **TOUCHING THE HEELS BEHIND THE BODY:** The left standing leg is extended, the right leg is raised in a cross back position and the foot is bent inside, the opposite (left) palm touches the heel, then the left leg is raised in a cross back position and the foot is bent inside, the opposite (right) palm touches the heel. Alternately raise your legs and touch the heels with the opposite palms.





11. **JUMPS APART – TOGETHER, CROSSING ARMS:** The starting position is a parallel standing position and hands at the side of the body. Jump into a standing position with legs apart and bent. Cross your arms in a forward extended position (palms facing downward). After that, jump back to a standing position with legs standing parallel.



12. **STANDING LEG LIFTS AND TOUCHING THE FOOT:** Bend your left standing leg slightly, raise your right leg, touch the right foot with the opposite (left) hand, then alternate.





13. **FROG JUMPS:** In order to perform the frog jump exercise, stand with your feet slightly wider than shoulder-width apart. Jump while pulling your knees up toward your armpits (knees as high as possible), your hands move from the bent overhand, palms facing downward, to the outstretched overhand, palms face down.



14. **DOUBLE-LEG JUMPS FORWARD:** From a standing position, narrow stance, jump forward (lift your knees as high as possible), rowing with your hands next to your body (from front to back).





15. **DOUBLE-LEG JUMPS BACKWARD:** From a standing position, narrow stance, jump backward (lift your knees as high as possible), rowing with your hands next to your body (from back to front).



16. **TWIST:** Jump with both legs from a standing position with the knees slightly bent to the left, to a standing position with the knees slightly bent to the right, rotating the trunk and arms in the opposite direction.







17. **CROSS COUNTRY SKI**: By putting one foot in front of the other (the centre of gravity is kept in the middle), perform jumps by switching legs in the air. Arms extended at the side of the body, palms showing inside, swinging alternately.



18. **CROSS COUNTRY SKI WITH ARMS MOVING UP AND DOWN**: Standing with one foot forward (the centre of gravity remains in the middle); perform jumps by alternating legs in the air. The arms are fully outstretched in front, palms facing downward, the arms alternating move up and down.





19. **WALKING WITH HEEL KICKS, PROPELLING:** Alternately shift from one leg to the other and shift the weight from the left foot to the right; when the left standing leg is on the floor, the right one is raised and bent back (heel to the buttocks), the arms are bent at the elbow and the fists are rotated around each other in front of the body.



20. **ROTATION OF THE HEAD:** Stand upright with your feet shoulder-width apart, rotating your head in one and the other direction.





21. **HEAD TILT TO THE SIDE:** Stand upright with your feet shoulder-width apart, tilt the head to the shoulder, place the palm to which the head was tilted up on the head and hold it in this position with slight downward pressure.



22. **KNEE ROTATIONS:** Stand upright with your feet slightly closer than shoulder-width apart, hold your arms extended to the side, lift one leg and move your knees in a circular motion, then switch legs.

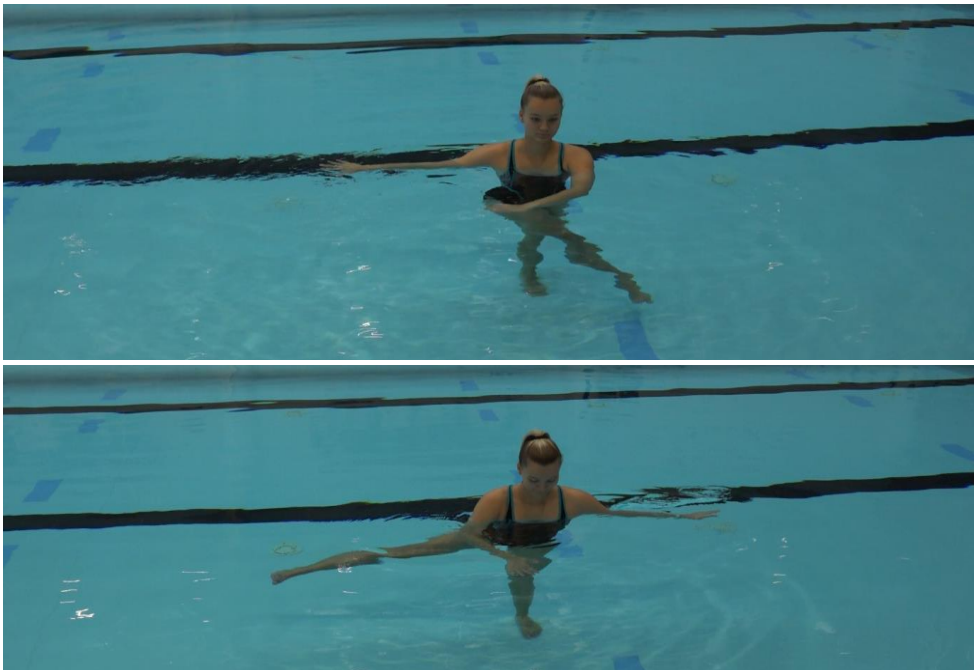




23. **HEEL-TO-TOE:** Stand upright with your feet slightly closer than shoulder-width apart, and switch from standing on your heels to standing on your toes. With your arms extended to the side, you maintain balance.



24. **SINGLE-LEG SWINGS TO THE SIDE:** Standing on one leg, with the other leg perform abduction and adduction movements, then perform abduction and adduction movements with the other leg.





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25. **SINGLE-LEG SWINGS FROM BACK TO FRONT:** Standing on one leg, with the other perform extension and flexion movements, then perform extension and flexion movements with the other leg.





26. **TRUNK DEFLECTION:** Stand upright with your feet slightly closer than shoulder-width apart, one hand rests on the hip, the other is stretched up. With the trunk make a lateral bend towards the bent arm at the hip. Perform lateral bends also on the other side.



27. **CROSS BODY KNEES:** Stand upright on one leg, drive your knee up and across your body, then alternately jump from one leg to the other and drive the other knee up and across the body.





28. **DELTOID STRETCH:** Stand upright with your feet slightly closer than shoulder-width apart, extend one hand forward, pull it to the body with the other and hold for a few seconds, then switch hands.



29. **TRICEPTS STRETCH:** Stand upright with your feet slightly closer than shoulder-width apart, raise one arm up and bend it behind the head, with the other hand grasp the bent arm slightly below the elbow and hold for a few seconds, then switch hands.





30. **SHOULDER AND NECK MUSCLES STRETCH:** Stand upright with your feet shoulder-width apart, put one arm in bent position (behind the back), grab the wrist with the other hand and pull slightly and hold, tilt the head to the side, hold for a few seconds, then switch hands.



31. **KNEE FLEXION:** Standing on one leg, lift the other leg in front of you, grab the bent knee with your hands and pull it to the body and hold it for a few seconds; then switch legs.







32. **QUADRICEPS STRETCH:** Standing on one leg, bend the other backwards and hold it by the ankle with your hand and hold it for a few seconds; then switch legs and arms.



33. **GLUTEUS STRETCH:** Bend the standing leg slightly and bend the other leg in front of the body over it (just above the knee) and hold for a few seconds, then switch legs; maintain balance with your hands.





34. **INTERLOCKING OF THE FINGERS IN THE FRONT:** Stand upright with your feet shoulder-width apart, interlock the fingers in front of the body and raise the arms in a forward extended position, make a hump with the back and hold for a few seconds.



35. **INTERLOCKING OF THE FINGERS ON THE BACK:** Stand upright with your feet shoulder-width apart, interlock the fingers behind the body and raise the arms as far as possible and open the chest, look up and hold for a few seconds.





36. **OUTER THIGH MUSCLES STRETCH:** Cross the bent leg in front over the extended standing leg, grab the bent knee with the opposite hand and hold for a few seconds.



37. **HAMSTRING STRETCH:** lift one leg outstretched in the front, grab the outstretched leg with your hands below the knee and hold for a few seconds.





38. **CALF STRETCH:** Lunge forwards onto your front leg until you feel a stretch in your calf muscle on the back leg, the heel is pressed against the ground as much as possible, the hips are pushed forward and hold for a few seconds.



39. **FOREARM STRETCH:** Extend one arm into an outstretched hand, palm facing up, grab the palm with the other hand and pull it down in a controlled manner and hold for a few seconds.





40. **ARMS SWINGS:** Stand upright with your feet slightly wider than shoulder-width apart, the arms are extended in front of you, palms facing down, and swing L, R with them.



41. **SLIDING HANDS:** Stand upright with your feet slightly wider than shoulder-width apart, hold your hands outstretched on the surface of the water, and slide with them from one side to the other.





42. **PUSHING WATER TO THE SIDE:** Stand upright with your feet slightly wider than shoulder-width apart, make a step from one leg to the other and at the same time rotate the trunk and push the water with one hand (if you turn to the left, the right hand pushes).



43. **JUMPING JACKS WITH ROTATION:** From the starting position, which is a parallel standing position, both knees and feet pointing forward, arms at the side of the body, you perform a jump to a standing position slightly bent, arms extended to the side and then a jump back to a parallel standing position, hands next to the body (at the same time, we turn once to the L, the second time to the R).





44. **TOY SOLDIER FORWARDS:** Stand upright, raise one arm and at the same time move the opposite leg forward, keep your knees straight, and the other arm is by your side. Keep switching your legs, moving them out and upwards in front of you with your arms swinging freely.



45. **TOY SOLDIER BACKWARDS:** Stand upright, raise one arm and at the same time move the opposite leg backward, keep your knees straight, and the other arm is by your side. Keep switching your legs, moving them out and backwards with your arms swinging freely.





46. **JOGGING FORWARD:** Keep your legs shoulder-width apart, alternately raise and contract your legs, so that there is a running phase, pull the elbows back and forth, in a coordinated manner you move forward.



47. **JOGGING BACKWARDS:** Keep your legs shoulder-width apart, alternately raise and contract your legs, so that there is a running phase, pull the elbows back and forth, in a coordinated manner you move backwards.







48. **TOUCHING THE FEET WITH FORWARD MOVEMENT:** Lift one leg into the front leg and touch the foot with the opposite hand, the standing leg is extended, then take a step forward with the bent leg and then bend the extended leg inward and touch the foot with the other hand; alternate and move forward.



49. **TOUCHING THE FEET WITH MOVEMENT IN REVERSE:** Lift one leg into the bent foreleg and touch the foot with the opposite hand, the standing leg is extended, then take a step backwards with the bent leg and bend the other foreleg and touch the foot with the opposite hand; alternate and move backwards.





50. **TOUCHING THE HEELS WITH FORWARD MOVEMENT:** Lift one leg and bend it backwards and crosswise, touch the heel with the opposite hand, the standing leg is extended, then take a step forward with the bent leg and bend the other leg backwards crosswise and touch its heel with the opposite hand; alternate and move forward.



51. **TOUCHING THE HEELS WITH MOVEMENT BACKWARDS:** Lift one leg and bend it backwards and to the side, touch the heel with the opposite hand. Stretch the standing leg, then take a step backwards with the bent leg and bend the other leg, touch its heel with the opposite hand, alternate the legs and move backwards.





52. **TOUCHING THE FEET AND THE HEELS ALTERNATELY (FORWARD):** Lift one leg into the foreleg bent inwards and touch the foot with the opposite hand, the standing leg is stretched, then take a step forward with the bent leg and bend the other leg and touch the foot with the opposite hand. Then take a step forward, this is followed by bending the first leg into extension inwards and touching the heel with the opposite hand, make a step forward and lift the other leg in extension bent inward and touch the heel with the opposite foot; alternate (foot, foot, heel, heel) and move forward.



53. **TOUCHING THE FEET AND HEELS ALTERNATELY (BACKWARDS):** Lift one leg into the foreleg bent inwards and touch the foot with the opposite hand, the standing leg is stretched, then take a step backward with the bent leg and bend the other leg and touch the foot with the opposite hand. Then take a step backward, this is followed by bending the first leg into extension inwards and touching the heel with the opposite hand, make a step backward and lift the other leg in extension bent inward and touch the heel with the opposite foot; alternate (foot, foot, heel, heel) and move backward.





54. **CROSS COOUNTRY SKI FORWARD:** Standing with one foot forward (the centre of gravity is kept in the middle), you perform jumps by switching legs in the air, arms stretched out next to the body swing alternately; you move forward with leaps.



55. **CROSS COOUNTRY SKI BACKWARDS:** Standing with one foot forward (the centre of gravity is kept in the middle), jumps are performed by switching legs in the air, alternating arms extended by the body; you move backwards with leaps.





56. **DOUBLE-LEG JUMPS FORWARD:** From a standing position (feet hip-width apart) you perform forward jumps (knees raised as high as possible), hands next to the body make a rowing movement (from front to back).



57. **DOUBLE-LEG JUMPS BACKWARD:** From a standing position (feet hip-width apart) you perform reverse jumps (knees raised as high as possible), hands next to the body make a rowing movement (from back to front).





58. **TWISTS TO THE SIDE:** Perform jumps from a standing position with one leg slightly bent to the left to a standing position with one leg slightly bent to the right, twisting the trunk and arms in the opposite direction; you move to one side with jumps.



59. **SKIPPING TO THE SIDE:** You alternately lift and contract your legs at a 90-degree angle from the body, so that there is a running phase, the arms move along the body in a coordinated manner and you move to the side.

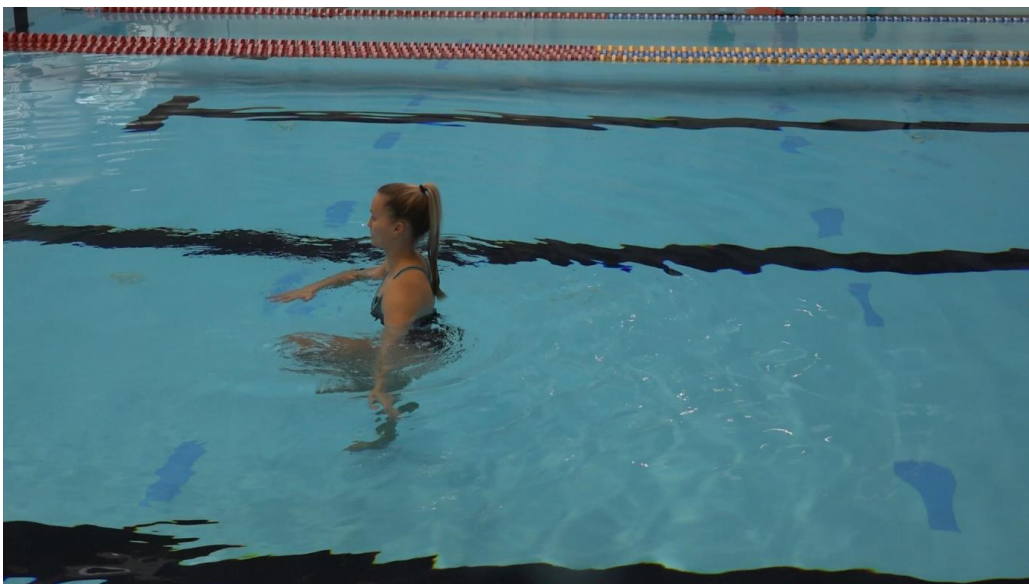




60. **SCOOPING WITH THE LEGS WITH FORWARD MOVEMENT:** First lift one leg into the front leg bend, then stretch it out and lower it to the floor slightly in front of the standing leg, then lift the other leg into the front leg bend, stretch it out and then lower it onto the floor slightly in front of the standing leg, alternate legs and move forward.



61. **SCOOPING WITH THE LEGS WITH BACKWARD MOVEMENT:** First lift one leg into the front leg stretched, then bend it and step on the floor behind the standing leg, then lift the previously standing leg into the stretched front leg, bend it and step on the floor behind the standing leg, alternate legs and move backwards.





62. **JOGGING FORWARD WITH BREAST STROKES:** Alternately pull Your legs in front of the body so that **THERE IS** a running phase and move forward, with your hands **MAKE** breaststrokes (the arms go simultaneously into a forward extension, palms inward, then move to the stretched forward position and bend inward and move again to the stretched forward position, palms inward).



63. **JOGGING BACKWARD WITH BREASTSTROKES:** Alternately bend and straighten your legs in front of the body so that there is a running phase and move backwards, help yourselves with the hands by making stroking movements (the arms move from the extended side position to the extended forehand and then return to the body and to the side extended hand).







64. **JOGGING FORWARD WITH SCOOPING:** Alternately bend and straighten your legs in front of the body so that there is a running phase and move forward, with your hands next to the body perform scooping strokes (from arms adducted at the sides stretch the arms with bent elbows up to the shoulders, palms facing down, lower the arm down to the side and raise the adducted arms again at the sides)



65. **REVERSE JOGGING WITH SCOOPING:** Alternately bend and straighten your legs in front of the body so that there is a running phase and move backward, with your hands next to the body perform scooping strokes (the arms are bent at the side, palms facing up, move the arms to an extended forward movement by the body, then to a forward outstretched position, and bend the arms again).





66. **SIDE STEPS WITH SCOOPING:** From a standing position, take a step to the side and then connect the other leg back to a parallel standing position, hands in front of the body perform simultaneous strokes, scoops (from bent arms at the side, to arms extended forward in front to extended to the side, palms facing downward, to arms at the sides and back to bent arms at the sides).



67. **SIDE LUNGE:** From a standing position, arms at your sides, take a step to the right, arms extended to the sides and push back to a parallel standing position, arms at the sides. Repeat the same on the left side.





68. **KNEE – ELBOW**: Stand hip-width apart, arms at your side, then bend one leg as high as possible, touch the knee with the elbow of the opposite hand, then step back into a parallel standing position and bend the other leg and touch the knee with the elbow of the opposite hand.



69. **JOGGING ON THE SPOT WITH ALTERNATE FORWARD PUNCHES (DUMBBELLS)**: Alternately lift and contract your legs so that there is a running phase, the hands alternately punch from the bent arms at the side to the extended arms forward, hold dumbbells in your hands.





70. **WALKING ON THE SPOT WITH ALTERNATE PUSHING OF THE DUMBBELLS TO THE SIDE:** The left standing leg extended, the right leg is bent in the knee in front of it, alternately lift your legs, at the same time one arm goes from bent position at the side to an extended position at the side and vice versa, hold dumbbells in your hands.



71. **EXTENDED LEG AND TOUCHING THE FEET WITH DUMBBELLS:** The standing leg is extended, lift the other leg into the foreleg extended, with the opposite hand, in which the dumbbell is held, touch the foot, the other hand is extended at the side, then step down on the floor and lift the other leg and with the opposite hand, in which we hold the dumbbell, touch the feet, alternate.





72. **CIRCLING IN FRONT OF THE BODY WITH DUMBBELLS:** Hold the dumbbells in your hands (press the dumbbells together) and perform circles in front of the body (when the arms are extended in front of the body, you bend your body forward).



73. **SWINGING IN FRONT OF THE BODY WITH THE DUMBBELLS:** Stand with your feet slightly wider than shoulder-width apart, hold the dumbbells in front hand extended to the side, then swing your hands under the water to the other side and back.





74. **CROSS COUNTRY SKI WITH DUMBBELLS:** By putting one foot in front of the other (the centre of gravity is kept in the middle), perform jumps by switching legs in the air, the arms stretched out next to the body are swinging alternately, holding dumbbells in your hands.



75. **TWIST WITH DUMBBELLS:** Perform jumps from a parallel standing position with one leg slightly bent to the left to a standing position with one leg slightly bent to the right, twisting the trunk and arms in the opposite direction, holding the dumbbells in your hands (sliding with them on the surface or moving them under the water surface).





76. **CROSS COUNTRY SKI, PUSHING FORWARD WITH DUMBBELLS:** By putting one foot in front of the other (the centre of gravity is kept in the middle), perform jumps by switching legs in the air, alternately flex and extend arms at your elbows as you pull the dumbbells in toward arm pits.



77. **JUMPS APART AND TOGETHER WITH CROSSING THE HANDS IN EXTENDED ARMS FORWARD:** From the starting position, which is a parallel standing position, arms at the sides, you make a jump to a shoulder-width standing position slightly bent, cross the arms in a forward position extended (holding the dumbbells in your hands) and then jump back to a parallel standing position.





78. **JUMPING JACKS WITH DUMBBELLS:** From the starting position, which is a parallel standing position, arms at the sides, you make a jump to a shoulder-width standing position slightly bent, the arms are extended to the side and then jump back to a parallel standing position, holding the dumbbells in your hands.



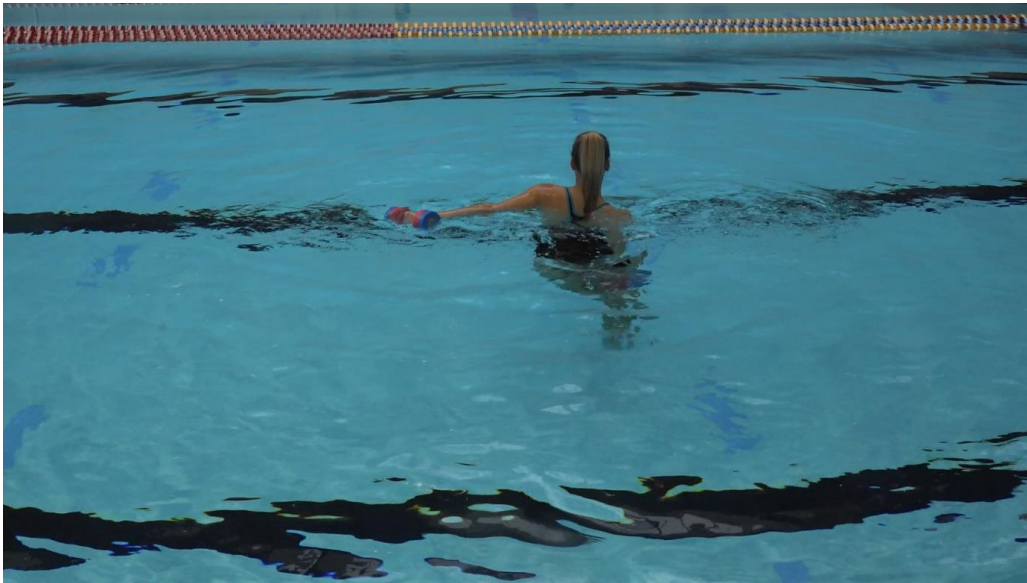
79. **ALTERNATE TOUCHING OF THE FEET IN FRONT OF THE BODY WITH THE DUMBBELLS:** Lift one leg into the foreleg bent inward and touch the foot with the opposite hand in which you hold the dumbbell, the standing leg is extended, then step on the ground with the bent leg and bend the other foreleg inward and touch the foot with the opposite hand (dumbbell); alternate.







79. **ALTERNATE TOUCHES OF THE HEEL BEHIND THE BODY WITH DUMBBELLS:** Lift one leg into the extension bent inward and touch the heel with the opposite hand in which you hold the dumbbell, the standing leg is extended, then step on the ground with the bent leg and bend the other leg in extension inward and touch the heel with the opposite hand (dumbbell); alternate.



80. **DOUBLE-LEG JUMPS FORTH AND BACK WITH DUMBBELLS:** From a slightly narrow hip-width standing position, perform jumps forward (lift knees as high as possible), hands next to the body make a rowing movement (from front to back) and backwards (lift knees as high as possible), hands next to the body make a rowing movement (from back to front); hold the dumbbells in your hands.

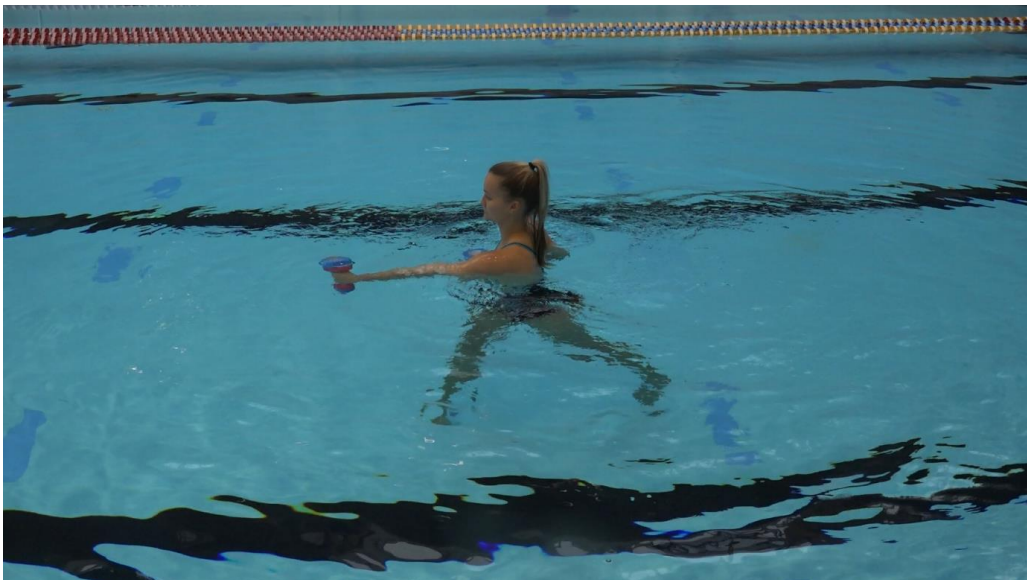




81. **FROG JUMPS:** From the starting position, feet slightly narrow hip-width apart, with the forehand bent, we jump into a bent spread (knees as high as possible), the hands in which you hold the dumbbells go into a forehand extended downwards.



82. **PUSHING WATER TO THE SIDE WITH THE DUMBBELLS:** While standing hip-width apart, make a step from one leg to the other and at the same time twist the trunk and push the water with one hand with the dumbbell (if we turn to the left, the right hand pushes).

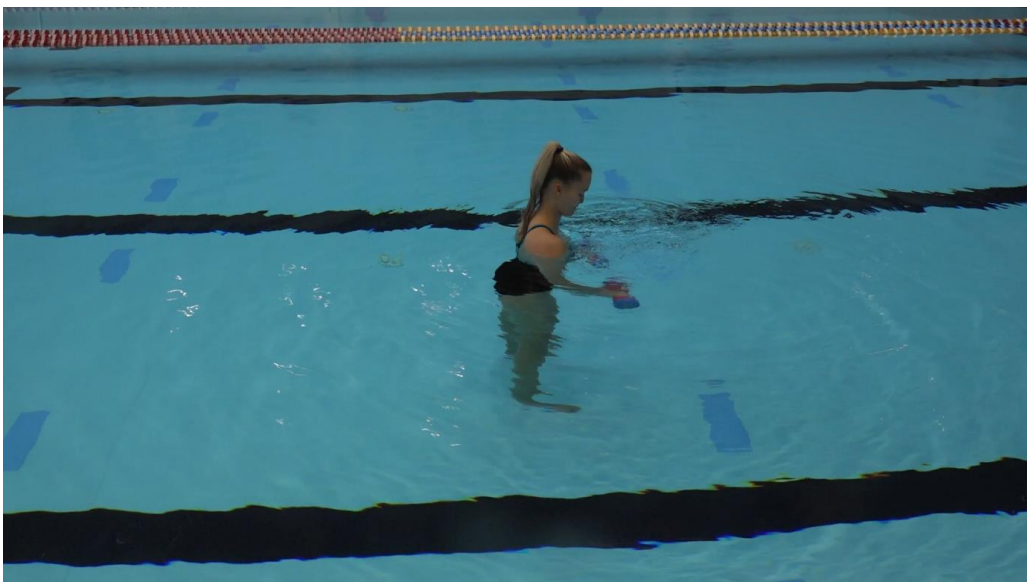




83. **DOUBLE-LEG 180-DEGREES JUMPS WITH DUMBBELLS:** Standing slightly narrow hip-width apart, hold the dumbbells in arms slightly bent forward, perform a double-leg jump with a turn to the right (bend the legs), circle the arms also to the right, thanks to the dumbbells you reach a weightless position.



84. **ELBOW EXTENSION WITH DUMBBELLS:** Stand in a balanced position (put one foot in front of the other), hold the arms bent up in the forward position and extend the elbows without moving the upper arms, then take the initial position of the arms (bend the arms).





85. **EXTENSION IN THE ELBOWS DOWNWARDS WITH THE ARMS NEXT TO THE BODY:** Stand in a balanced position, in the bent arms at your side you hold dumbbells and perform extensions in the elbows and then contractions back to the starting position.



86. **EXTENSION IN THE ELBOWS DOWN WITH DUMBBELLS, BEHIND THE BACK:** Stand hip-width apart, while holding dumbbells in your contracted arms in the back and perform extensions in the elbows and contractions back to the starting position.





87. **SINGLE-ARMED CIRCULAR MOVEMENT IN THE ELBOW WITH DUMBBELLS:** Stand hip-width apart, one arm is extended (holding the dumbbell), the other arm is bent (holding the dumbbell) and you perform an extension in the elbow until the hand is stretched out, then return through the outstretched hand back to the starting position; repeat the movement and then do the same with the other hand.

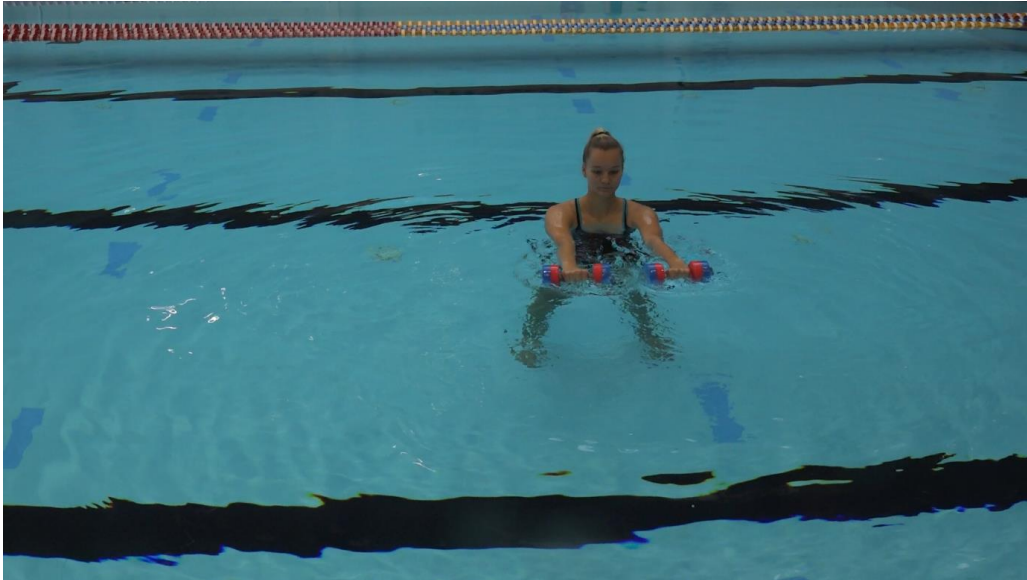


88. **SINGLE-ARM CIRCULAR MOVEMENT IN THE ELBOW WITH DUMBBELL (other direction):** Stand hip-width apart, one arm is extended at the side (holding the dumbbell), the other arm is extended at the side (holding the dumbbell) and this arm travels through the hand extended at the side to the arm bent at the side and back to the starting position; repeat the movement and then do the same with the other hand.





89. **BEND IN THE SHOULDER, WITH DUMBBELLS:** Stand hip-width apart, the arms are extended forward, hold dumbbells in your hands, perform shoulder bends, extend the arms to the side and back.



90. **HORIZONTAL BEND IN THE SHOULDER:** By putting one foot in front of the other, the body is slightly bent forward, hands are extended to the side, hold the dumbbells in your hands and perform a horizontal bend in the shoulder until the arms are extended forward (movement under the water surface).



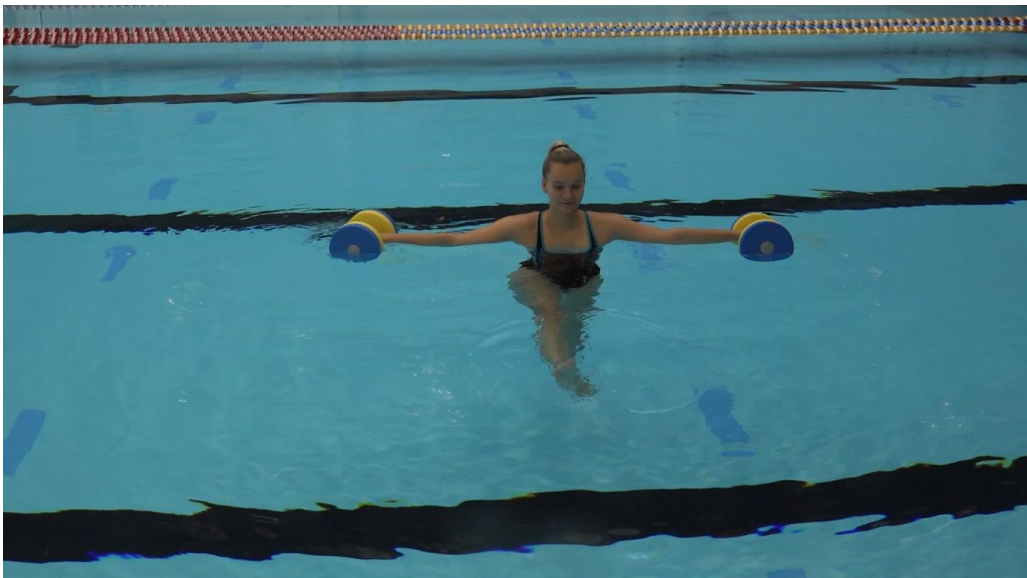


91. **INTERNAL AND EXTERNAL ROTATION IN THE ELBOW, WITH DUMBBELLS:**

Stand hip-width apart, the hands are bent outward at the side, hold dumbbells in your hands, perform an internal rotation in the elbow toward your chest and back to the starting position.

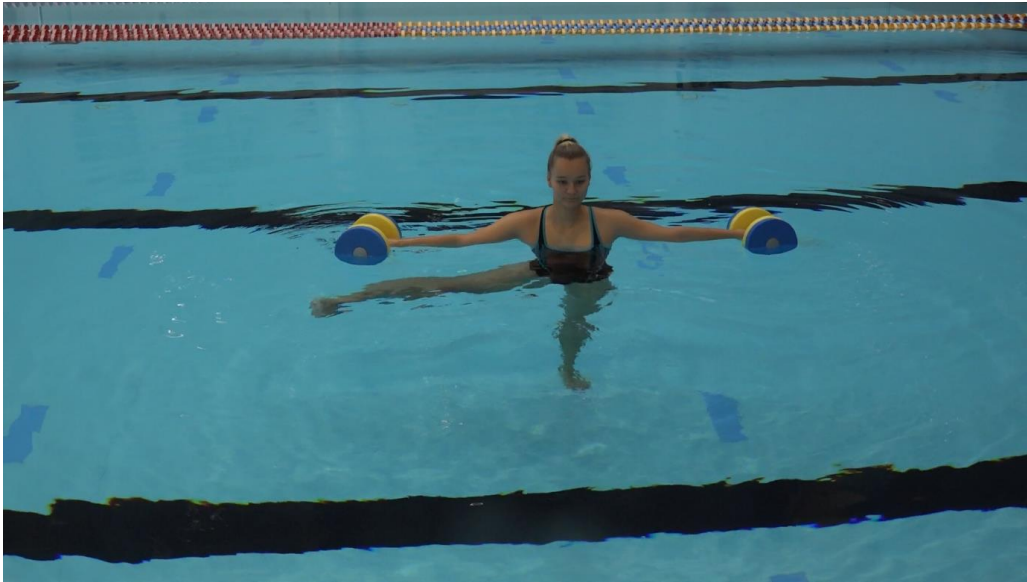


92. **HIP FLEXION:** Stand hip-width apart, the arms are extended to the side and perform single-legged hip flexions until the foreleg is extended in front of the body (foot up) and return to the starting position. Repeat with the other leg.

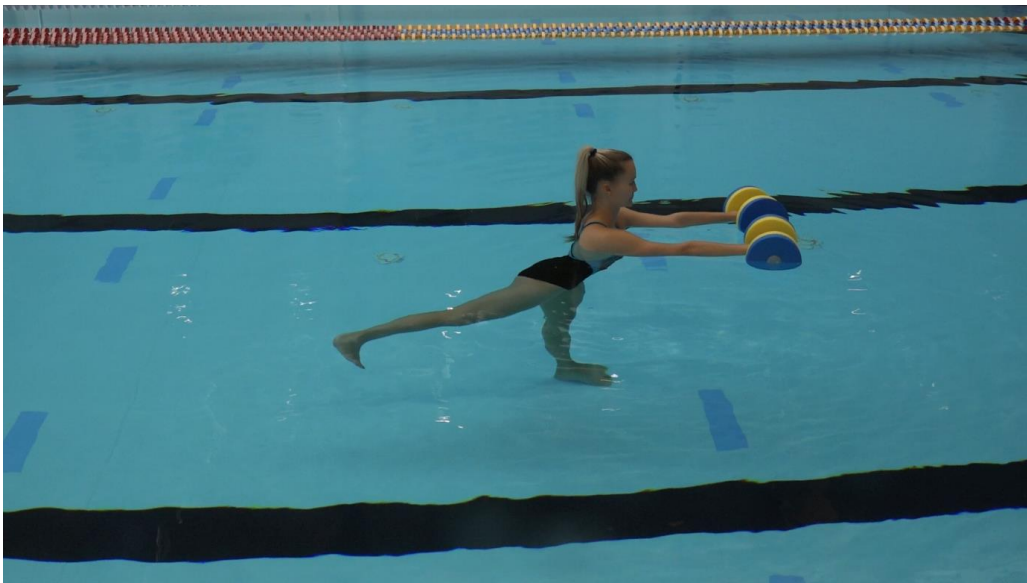




93. **HIP ABDUCTION:** Stand hip-width apart, hands extended to the side, and perform single-legged hip abductions until the leg is extended backwards (extend the leg to the point where you can keep the hips in the starting position) and back to the starting position. Repeat the movement with the other leg.



94. **HIP EXTENSIONS:** Stand hip-width apart, hands extended to the side, and perform single-legged hip extensions until your leg is extended back (the leg is extended to the point where you can maintain the same lumbar curve, without increasing it, and without rounding the trunk) and return to the starting position. Repeat the movement with the other leg.







95. **HIP ABDUCTIONS WITH LEG BENT IN THE KNEE:** Stand narrower than hip-width apart, lift one leg in front of you bent in the knee and abduct the leg in the hip in bent position (the abduction is performed until you can maintain the initial position of the hips, without additional twisting).



96. **PULLING THE KNEES AND STRETCHING THE LEGS BACK AND FORTH:** Stand hip-width apart, hands extended to the side, hold dumbbells/dumbbells in your hands, then pull both knees to your chest, extend the legs in front of the body, pull the knees in again and then extend the legs behind the body.





97. **PULLING THE KNEES AND EXTENDING THE LEGS TO THE SIDE:** Stand hip-width apart, hands extended to the side, hold dumbbells/dumbbells in your hands, then pull both knees to your chest, extend the legs to one side (laterally), pull the knees in again and then extend the legs to the other side of the body.



98. **SINGLE-LEGGED STEP ON THE POOL NOODLE:** stand slightly narrow hip-width apart, hands extended to the side, with one leg step on the pool noodle and perform a hip and knee flexion and then press the foot downwards until the leg is extended.

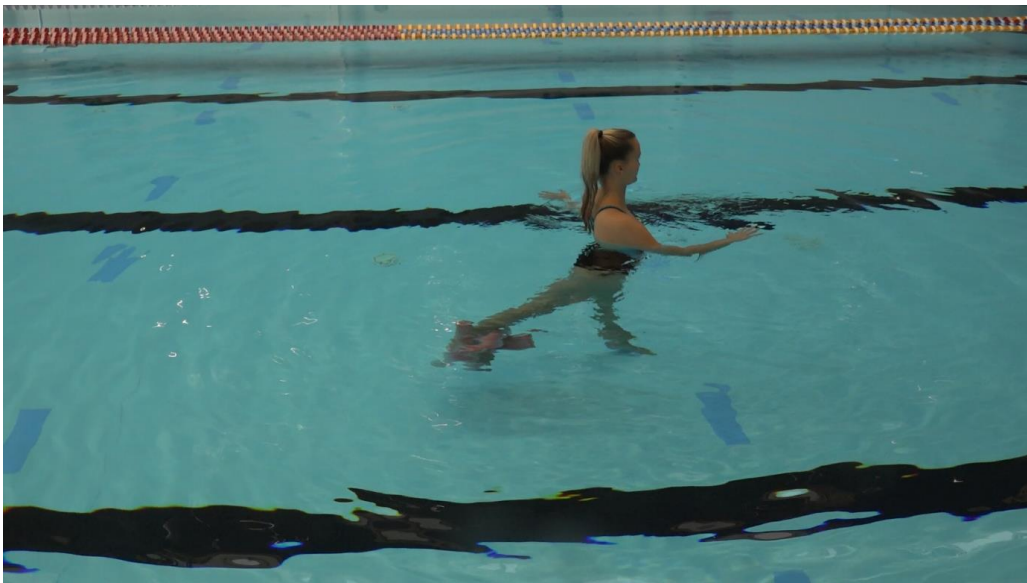




99. **HIP FLEXION TO THE SIDE WITH A POOL NOODLE:** Stand hip-width apart, hands extended to the side, tuck the worm under your foot and perform single-legged hip flexions the leg is fully extended to the side (the leg is stretched so far that the hip can be held in the starting position) and back to the starting position. Repeat the exercise with the other leg.



100. **HIP EXTENSIONS WITH A POOL NOODLE:** Stand slightly narrow hip-width apart, hands extended to the side. With the pool noodle we make a loop into which we insert the foot of one leg and perform stretches in the hip from flexion to extension (the body is straight, we do not increase the lumbar curve).





101. **CIRLING THE HIPS WITH THE POOL NOODLE:** Standing slightly narrower than hip-width apart, arms are extended to the side. We make a loop with the pool noodle, into which we insert the foot of one leg and circle with it (the leg is extended forwards, then to the side and backwards).

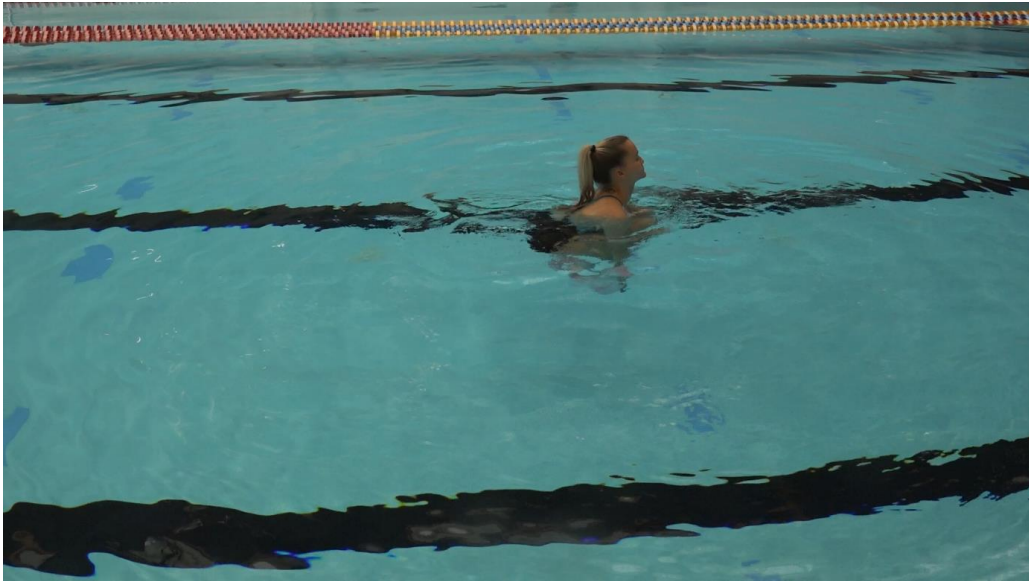


102. **STEPPING ON THE POOL NOODLE (with both feet):** Step on the pool noodle with both feet and then bend the legs and push the pool noodle to the floor, extend the legs. The hands are extended to the side to maintain balance.

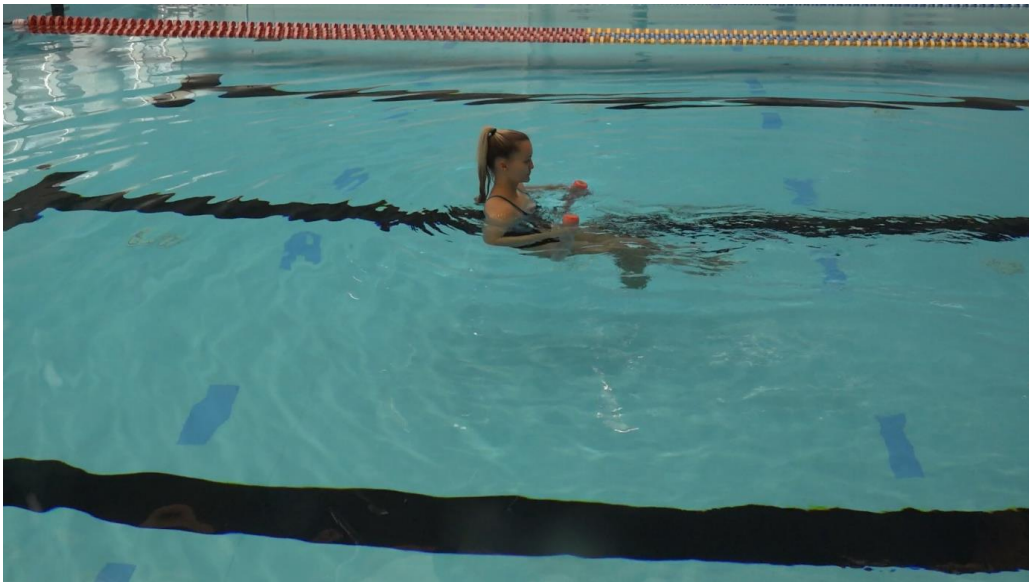




103. **POOL NOODLE JUMP ROPE:** Hold the pool noodle like a jump rope under the water and perform double-legged jumps over it (back and forth).



104. **SITTING ON A POOL NOODLE WITH KICKS:** Sit on the pool noodle and perform alternating kicks by moving backwards.

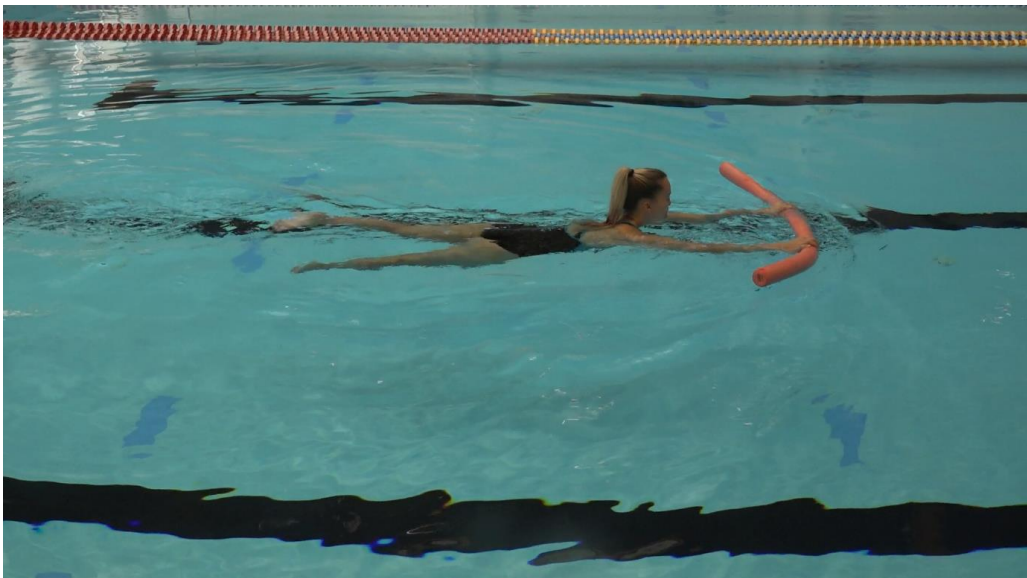




105. **SITTING ON THE POOL NOODLE WITH BREASTSTROKES:** Sit on the pool noodle, the legs do not move, and perform breaststrokes with your hands, the arms are simultaneously extended forward, palms inwards, then the arms travel to the side extended and crouch inward and travel again forward extended, palms inwards).

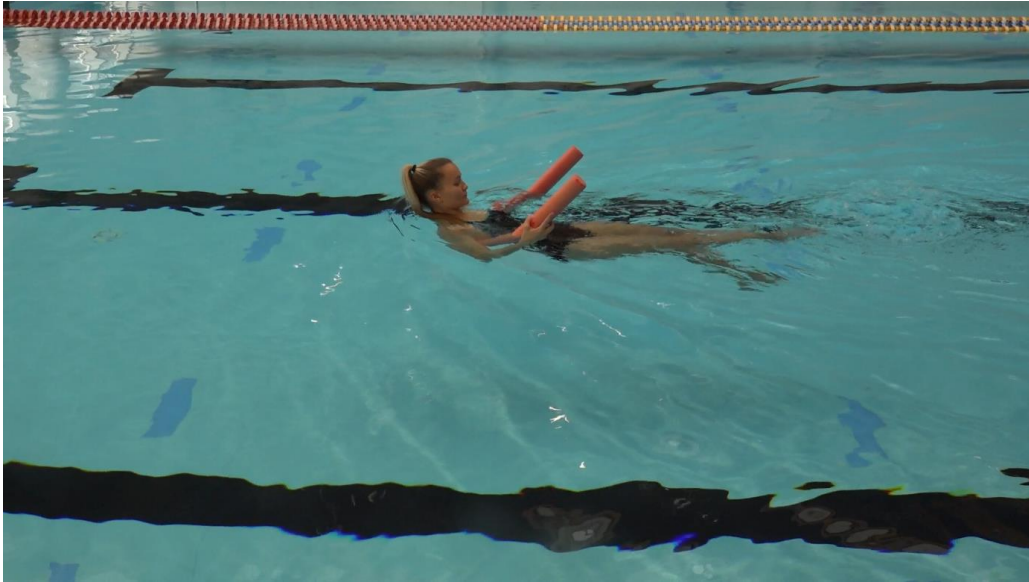


106. **CRAWL STROKES HOLDING THE POOL NOODLE WITH EXTENDED ARMS:** Take a lying position on the stomach, hold the horizontally positioned pool noodle with forward stretched arms, perform alternating crawl strokes with the legs.

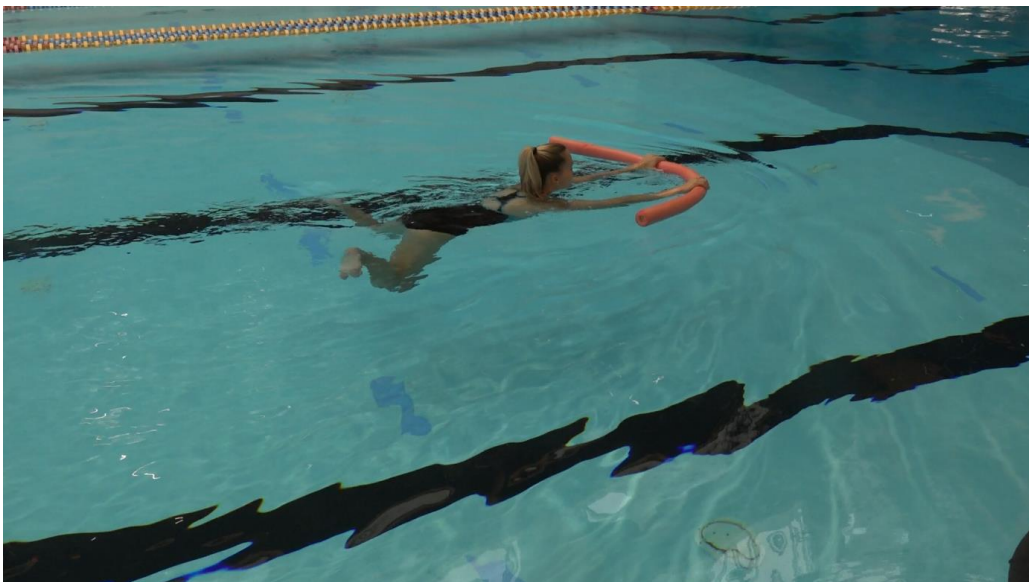




107. **KICKS ON THE BACK WITH LEANING ON THE POOL NOODLE:** Take a lying position on the back and lean on the pool noodle and perform kicks (alternating kicking with outstretched legs).

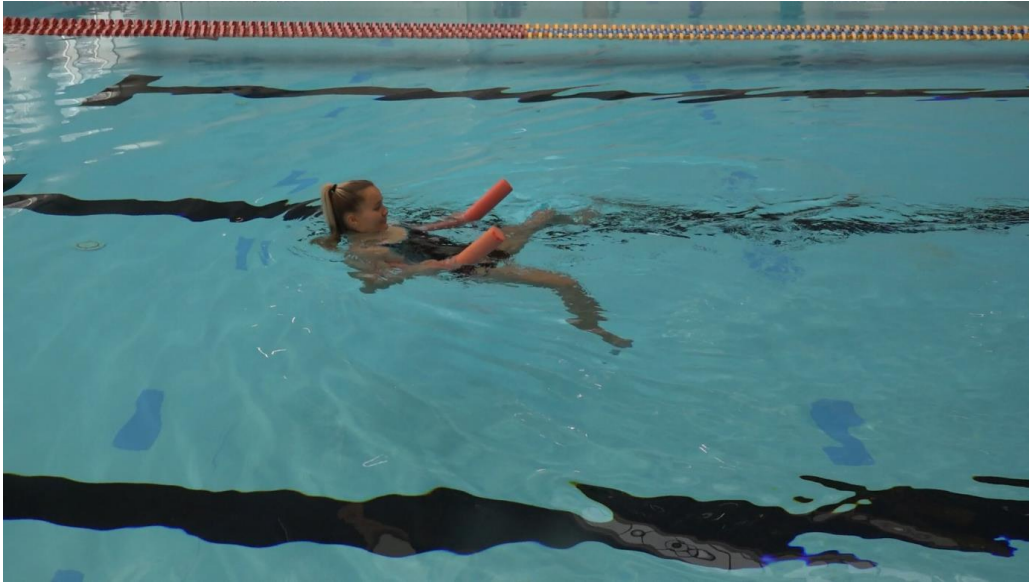


108. **BREASTSTROKES HOLDING THE POOL NOODLE IN THE EXTENDED FOREHAND:** Take a lying position on the stomach, hold the horizontally placed pool noodle in the forehand extended, perform leg kicks as in breaststroke swimming.

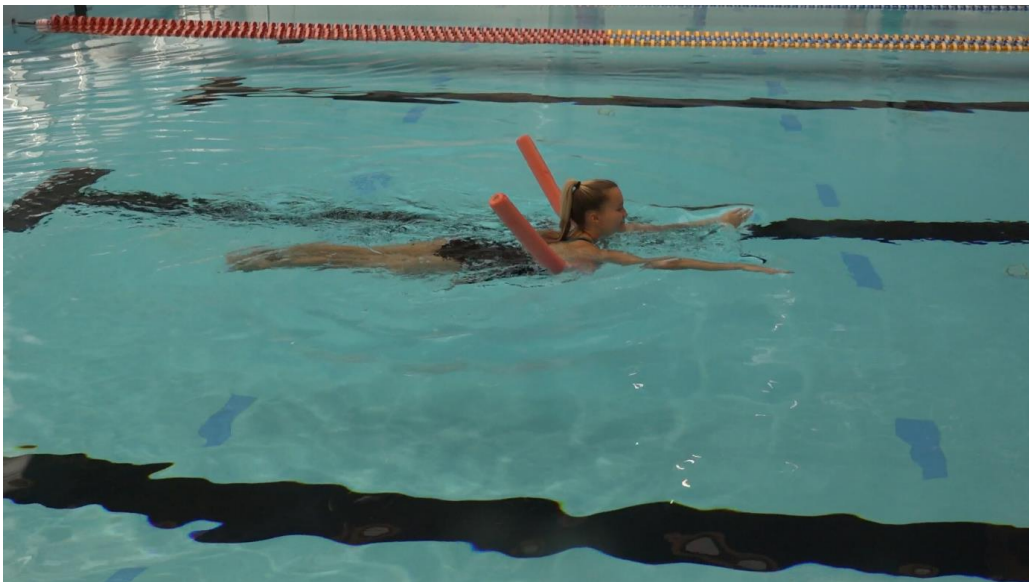




109. **BREASTSTROKE WITH LEANING ON THE POOL NOODLE:** Take a lying position on your back and lean on the pool noodle, perform leg kicks as in breaststroke swimming.



110. **FROG WITH THE HELP OF A POOL NOODLE:** Take a lying position on the stomach and lean on the pool noodle and swim the frog style.







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*Figure 20. Exercise led by a member of the Post-COVID Swimming Project Group*



## 11. APPENDICES

### QUESTIONNAIRES FOR POST-COVID PATIENTS

Post-COVID survey

1. Name and surname

2. Date of birth

3. Do you have chronic diseases (e.g., diabetes, hypertension, arthritis, asthma...)?

If you don't have one, write NO, and if you have one, state which \_\_\_\_\_

4. How many times in total have you contracted the disease COVID-19?

- One time
- Two times
- Three times
- Four times
- More than four times

5. How long ago was the last time you fell ill with the disease COVID-19?

- Less than a month ago
- A month ago
- 2 months ago
- 3 months ago
- 4 months ago
- 5 months ago
- 6 months ago
- 12 months ago
- 18 months ago
- 24 months ago
- 30 months ago
- More than 30 months ago

6. Mark which symptoms you had (YES/NO):

- Sore throat YES/NO
- Dry cough YES/NO
- Shortness of breath/laboured breathing YES/NO
- Pneumonia YES/NO
- Chest pain YES/NO
- High body temperature YES/NO
- Sudden loss of sense of smell/taste YES/NO
- Cardiovascular system problems (Heart arrhythmias, blood pressure)



- Headache YES/NO
- General weakness YES/NO
- Muscle pain YES/NO
- Digestive problems (nausea, vomiting, diarrhoea, abdominal pain) YES/NO
- Fever (stuffy nose, sneezing, slightly elevated temperature) YES/NO
- Memory problems YES/NO
- Hair loss YES/NO
- Vision problems YES/NO

6. How long did the symptoms last?

- 1-3 days
- 3-7 days
- 7-14 days
- A month
- Two months
- 3 months and more

7. What were the symptoms?

- Mild
- Medium
- Strong

8. Have you been hospitalized?

- Yes, I am
- I am not

9. If yes, which of the above did you receive in the hospital?

- Oxygen replacement
- Intensive care
- Mechanical ventilation

10. How long were you in the hospital?

\_\_\_\_\_ days

11. What symptoms do you still have?

- Sore throat
- Dry cough
- Shortness of breath/difficulty breathing
- Pneumonia
- Chest pain
- High body temperature
- Cardiovascular system problems (cardiac arrhythmias, blood pressure)



- Headache
- General weakness
  
- Muscle pain
- Digestive problems (nausea, vomiting, diarrhoea, abdominal pain)
- Fever (stuffy nose, sneezing, slightly elevated temperature)
- Memory problems
- Hair loss
- Vision problems

12. How many hours per week did you train before the COVID-19 infection?  
\_\_\_\_\_ hours

13. How many hours per week did you train after the COVID-19 infection?  
\_\_\_\_\_ hours

14. Have you been vaccinated against the disease COVID-19?

- Yes, I am
- No, I am not
- I don't want to state

15. If yes, with which vaccine?  
\_\_\_\_\_

16. How many doses of the COVID-19 vaccine were you vaccinated with?

- One
- Two
- Three
- More than three
- I don't want to state



## 2. FATIGUE QUESTIONNAIRE

This 20-item questionnaire is designed to assess five dimensions of fatigue: general fatigue, physical fatigue, decreased motivation, decreased activity, and mental fatigue.

With the help of the following statements, we want to gain insight into how you have been feeling lately.

Choose which state suits you, on a scale from Completely agree to Completely disagree.

1-I completely agree

2-I agree

3-I neither agree nor disagree

4-I don't agree

5-I don't agree at all.

1. I feel capable 1 2 3 4 5
2. Physically, I feel able to do only a little 1 2 3 4 5
3. I feel very active 1 2 3 4 5
4. I feel that I can do all kinds of nice things 1 2 3 4 5
5. I feel tired 1 2 3 4 5
6. I think I work a lot during the day 1 2 3 4 5
7. While doing something I can focus my attention on it 1 2 3 4 5
8. I can dumbbell physically a lot 1 2 3 4 5
9. I am afraid to do some things 1 2 3 4 5
10. I feel that I do very little during the day 1 2 3 4 5
11. I can concentrate well 1 2 3 4 5
12. I am rested 1 2 3 4 5
13. It takes a lot of effort for me to concentrate on something 1 2 3 4 5
14. I feel that I am in bad physical condition 1 2 3 4 5
15. I have a lot of plans 1 2 3 4 5
16. I get tired easily 1 2 3 4 5
17. I finish few things 1 2 3 4 5
18. I feel like I don't feel like working 1 2 3 4 5
19. My thoughts wander easily 1 2 3 4 5
20. I feel that I am in excellent physical condition 1 2 3 4 5



### 3. Questionnaire about health *EQ-5D-5L*



Check only ONE box that best describes your health TODAY.

#### SELF CARE

- I have no problem washing or dressing.
- I have slight problems when washing or dressing.
- I have moderate problems when washing or dressing.
- I have big problems when washing or dressing.
- They cannot wash or dress themselves.

#### MOBILITY

- I have no problem moving around.
- I have slight trouble getting around.
- I have moderate trouble getting around.
- I have a lot of trouble moving around.
- I can't move around.

#### USUAL ACTIVITIES (e.g. work, school, household chores, family or leisure activities)

- I have no problems doing my usual activities.
- I have slight problems in carrying out my usual activities.
- I have moderate problems doing my usual activities.
- I have a lot of trouble doing my usual activities.
- I can't do my usual activities.

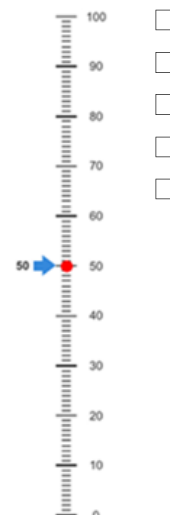
#### PAIN/DISCOMFORT

- I feel no pain or discomfort.
- I feel slight pain or discomfort.
- I feel moderate pain or discomfort.
- I feel severe pain or discomfort.
- I feel extreme pain or discomfort.

#### ANXIETY/DEPRESSION

- I'm not anxious or depressed.
- I am mildly anxious or depressed.
- I am moderately anxious or depressed.
- I am very anxious or depressed.
- I am extremely anxious or depressed.

- We want to know how good or bad your health is TODAY.
- This scale is numbered from 0 to 100.





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- 100 indicates the best health imaginable.
- 0 indicates the worst health imaginable.
- Press the place on the scale that indicates your health TODAY.
- The best health state I can imagine

YOUR HEALTH TODAY = 50

The worst health you can imagine

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## QUESTIONNAIRE REGARDING FATIGUE

The purpose of this 20-item questionnaire is to evaluate five dimensions of fatigue: general fatigue, physical fatigue, decreased motivation, decreased activity, and mental fatigue.

<p>Instructions: With the help of the following statements, we aim to gain an understanding of your recent emotional state. One such statement is: "I FEEL RELAXED"</p> <p>If you strongly agree and feel that the statement "I feel relaxed" accurately describes your recent emotional state, please mark an "X" in the far-left box Yes, that is correct    <input type="checkbox"/>1 <input type="checkbox"/>2 <input type="checkbox"/>3 <input type="checkbox"/>4 <input type="checkbox"/>5    No, that is not correct</p> <p>Please indicate your level of agreement or disagreement with each statement by placing an "X" in the corresponding box. Ensure that you do not skip any statement and only mark one box for each statement. The positioning of the "X" can be closer to the "no, that's not true" side if you strongly disagree with the statement.</p>								
1.	I feel capable of handling various tasks and activities	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
2.	Physically, I feel capable of performing only minimal tasks or activities.	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
3.	I feel very active	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
4.	I feel like I can do all kinds of beautiful things	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
5.	I feel tired	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
6.	I think that I work a lot during the day	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
7.	When engaged in an activity, I am able to concentrate and direct my attention towards it	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
8.	I have a high physical endurance and can dumbbell a significant amount of physical activity.	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
9.	I'm afraid to engage in certain activities or tasks	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
10.	I have noticed that my daily activities and productivity are minimal.	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true





11.	I can concentrate well	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
12.	I feel well-rested	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
13.	It takes a lot of effort for me to concentrate on something	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
14.	I feel that I am in bad physical shape	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
15.	I have a lot of plans	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
16.	I tire easily	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
17.	I am able to accomplish a few tasks or complete a limited number of activities	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not correct
18.	I am experiencing a lack of motivation or desire to engage in any activities.	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
19.	My thoughts wander easily	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true
20.	I feel that I am in excellent physical shape	Yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	No, that is not true



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#### 4. FOOD FREQUENCY QUESTIONNAIRE (FFQ)

##### DEMOGRAPHIC DATA:

##### 1. (D1) Year of birth:

Write in the blank spaces:

--	--	--	--

##### 2. (D2) Gender:

Choose one of the following options:

Š Male

Š Female

##### 3. (D3) Education:

Choose one of the following options:

- Level 1 of education (primary school – incomplete)
- Level 2 of education (primary school - completed)
- Level 3 of education (lower vocational education – 2 years)
- Level 4 of education (lower vocational education – 3 years)
- Level 5 of education (Upper secondary education, high school)
- Level 6 of education (higher / university education)
- Level 7 of education (master's degree)
- Level 8 of education (Master of Science / Ph.D.)



**FOOD:**

**4. (1a)**

The table below lists the types (groups) of foods. Try (as accurately as possible) to determine how often you eat or drink any of the listed products. Think about your average for the entire year.

Mark with an X the appropriate answer for each item:

	Never	Less than once a month	1 – 3 times a month	Once a week	2 – 4 times a week	5 – 6 times a week	Once a day	2 – 3 times a day	More than 3 times a day
Water (tap, bottled)									
Coffee, Tea									
Fruit / Vegetable juice									
Non-alcoholic beverages									
Sports drinks (isostar)									
Energy drinks (red bull)									
Wine									
Beer									
Non-alcoholic beer									
Spirits									
Enriched soy/cereal drinks (e.g. with calcium)									
Non-enriched soy/cereal drinks (e.g. with calcium)									
Milk (chocolate milk...)									
Yogurt, cheese									



### 5. (1b)

The table below lists the types (groups) of foods. Try (as accurately as possible) to determine how often you eat or drink any of the listed products. Think about your average for the entire year.

Mark with an X the appropriate answer for each item:

	Never	Less than once a month	1 – 3 times a month	Once a week	2 – 4 times a week	5 – 6 times a week	Once a day	2 – 3 times a day	More than 3 times a day
Chocolate, Sweets									
Pastries									
Sweets (baked goods, croissants, tarts)									
Seeds (sunflower, sesame...)									
Nuts (pistachios, peanuts, almonds)									
Dried fruits									
Fruits									
Cereals									
White bread, (white bread products)									
Dark/wholemeal bread, whole-meal products									



### 6. (1c)

The table below lists the types (groups) of foods. Try (as accurately as possible) to determine how often you eat or drink any of the listed products. Think about your average for the entire year.

Mark with an X the appropriate answer for each item:

	Never	Less than once a month	1 – 3 times a month	Once a week	2 – 4 times a week	5 – 6 times a week	Once a day	2 – 3 times a day	More than 3 times a day
Sweet spreads (jam, chocolate...)									
Cheese, Curd									
Meat products/sausages (smoked, preserved, salad with meat...)									
Meat (mutton, horse, beef, pork...)									
Venison									
Offal (liver, kidney)									
Fish / fish products									
Clams / Shellfish									
Vegetarian / vegetable salads (hummus)									
Meat substitutes (tofu...)									
Eggs									



### 7. (1d)

The table below lists the types (groups) of foods. Try (as accurately as possible) to determine how often you eat or drink any of the listed products. Think about your average for the entire year.

Mark with an X the appropriate answer for each item:

	Never	Less than once a month	1 – 3 times a month	Once a week	2 – 4 times a week	5 – 6 times a week	Once a day	2 – 3 times a day	More than 3 times a day
Pasta									
Rice and other grains (kamut, millet, wheat...)									
Fried potatoes (French fries, croquettes)									
Baked potatoes									
Boiled potatoes (mashed...)									
Legumes (beans, lentils, peas)									
Raw vegetables									
Cooked vegetables									
Chips / fried snacks									
Mayonnaise-based sauces (tartar...)									
Dressings									
Ketchup									



**8. (2)**

**How often do you use these greases for lubrication? Think about your average for the entire year**

Mark with an X the appropriate answer for each item:

	Never	Less than once a month	1 – 3 times a month	Once a week	2 – 4 times a week	5 – 6 times a week	Once a day	2 – 3 times a day	More than 3 times a day
Margarine									
Butter, grease									

**MEALS:**

**9. (3)**

**Indicate how often your meals are in the table below. Note: only a drink (one cup of milk, one cup of coffee) cannot be counted as a meal.**

Mark with an X the appropriate answer for each item:

	Never	Less than once a month	1 – 3 times a month	Once a week	2 – 4 times a week	5 – 6 times a week	Once a day	2 – 3 times a day	More than 3 times a day
Breakfast									
Lunch									
Dinner									



**EATING HABITS:**

**10. (4) What is your diet?**

Choose one of the following options:

- Vegan (no food of animal origin)
- Vegetarian (without meat and fish)
- Almost vegetarian (except meat and fish)
- Occasional - vegetarian (vegetarian food several times a week)
- I don't eat meat or fish
- Omnivore (meat and fish almost every day)

**FOOD SUPPLEMENTS:**

**11. (5) Do you use nutritional supplements regularly?**

Choose one of the following options:

- YES
- NO

**12. (5a) Enter the name and description (trademark) of the supplement in the fields below and the entry for each supplement to the frequency of use**

**Answer this question only if you answered "YES" to the previous question**

	Name and description	Usage (1x day / 1 x week)
Supplement:		
Supplement:		
Supplement:		
Supplement:		
Supplement:		

**BIOMETRIC DATA:**

**13. (6) Body height?**

**14. (7) Body weight?**

Thank you for completing this questionnaire!





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TEST FORM (private)



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DATE OF TESTING:

NAME AND SURNAME	
DATE OF BIRTH	
HEIGHT	
BODY MASS	
WAIST	
PULS	
PRESSURE	
O2	
6-MIN WALK	
2-MIN WALK	
SIT AND REACH	
HANDGRIP	
SEAT 30s	
ABS	
Y BALANCE TEST	
ANTERIOR R	
ANTERIOR L	
POSTEROMEDIAL R	
POSTEROMEDIAL L	
POSTEROLATERAL R	
POSTEROLATERAL L	
ANTERIOR R	
WATER TEST	
WATER (MIN)	
WATER (BORG)	



## Liability Statement

### IZJAVA NA LASTNO ODGOVORNOST

Podpisan(a).....izjavljam, da sem seznanjen(a) s programom vadbe v vodi za post covid prebolevalnike. Poznam absolutne in relativne kontraindikacije za vadbo v bazenu in jih bom upošteval(a). Sprejemam odgovornost za sodelovanje v vašem programu. Če bom opazil(a) katerokoli nelagodno spremembo na otroku ali meni med vadbo ali po vadbi, bom to takoj sporočil(a) vodji programa in/ali vaditelju. Razumem zgoraj navedene stavke.

V skladu z GDPR izjavljam, da dajem Plavalni zvezi Slovenije (PZS) izrecno privolitev za obdelavo osebnih podatkov in podatkov testiranja med vadbo za posredovanje informacij in v raziskovalne namene.

Kraj in datum:

Podpis:

### LIABILITY STATEMENT

I, the undersigned, hereby declare that I am aware of the water exercise program for PostCOVID reconvalescents. I am aware of the absolute and relative contraindications for aquatic exercise and will follow them. I accept responsibility for participating in your program. If I notice any uncomfortable changes in the child or myself during or after the exercise, I will immediately inform the program leader and/or instructor. I understand the sentences above.

In accordance with the GDPR, I declare that I give explicit consent to the Swimming Association of Slovenia to process personal data and test data during training for the forwarding of information and for research purposes.

Place and date:

Signature:



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