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WATER EXERCISE REHABILITATION FOR PEOPLE
SUFFERING FROM NON-SPECIFIC CHRONIC LOW BACK
PAIN

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Water exercise offers many advantages in term of exercising to maintain physical conditions and rehabilitation. The water element has many properties that reduces compressive force on discs and allows persons who suffers from pain to get into different postures that would be difficult in land-based therapeutic exercise.

The aim of this thesis is to propose a package to clients who suffers from non-specific low back pain to benefits of a designed training programme through specific movement performed in the water element instead of traditional exercises to reduce or get rid of pain in the lumbar region. Based on most recent scientific literature on pain and the treatment of non-specific chronic low back pain, and its treatment. The product has been delivered to physiotherapist working with the Satakunnan selkäyhdistys who offers water exercise for people experiencing chronic low back pain.

Subjective questionnaire has been designed to evaluate the level of satisfaction of participants and if they felt a decrease in their experience of pain after performing water exercise but has not been returned. No conclusions can be done.

CONTENTS

1	INTRODUCTION	4
2	AIM AND OBJECTIVES OF THE THESIS	4
3	LOW BACK PAIN	5
3.1	The anatomy of low back pain.....	5
3.2	Factors contributing to chronicity of low back pain.....	8
3.3	Low back pain treatment guidelines	9
4	PAIN.....	11
4.1	Acute, sub-acute and chronic pain.....	11
4.2	Sensitization.....	12
5	AQUA THERAPY	13
5.1	Use of water and pain.....	13
5.2	Buoyancy	14
5.3	Hydrostatic pressure.....	14
6	LOW BACK PAIN ASSOCIATION	15
7	THERAPEUTIC EXERCISE.....	16
7.1	Basic principles of therapeutic exercise.....	16
7.2	Benefits of therapeutic exercises.....	17
7.3	Therapeutic exercise in chronic low back pain.....	18
7.4	Method of delivery.....	19
8	IMPLEMENTATION	20
9	DISCUSSION	22
	APPENDICES	

1 INTRODUCTION

Low back pain is the most common world-wide disease that could affect anyone regarding the gender, age, or profession. It is disease that is perceived as well as an economical and societal burden than a health issue, due to the fact that the disability related to low back pain is cost effective and lead people out of work activity. (Hartvigsen, 2018, 2361)

This thesis has been conducted in co-operation with the Satakunnan selkäyhdistys. The Satakunnan selkäyhdistys has been contacted on behalf of the representative of SAMK to design and offer a package consisting of water-based exercise program for people suffering from non-specific chronic low back pain. The participants are consisted of a group of ten women who are participating to water exercise performed by physiotherapist or certified personal trainers twice in a week.

In agreement with the physiotherapist working for the Satakunta selkäyhdistys, water exercise program will be designed and delivered to personal intervening with group participating in water exercise. It will be presented under the form of paper document with picture with text explaining how to perform the movement and their muscle and goal targeted.

The thesis will go through the most recent scientific literature exploring the domain of pain and low back pain. The use of water exercise will be presented and benefits of therapeutic exercise in literature will be focusing on the benefits it provides in term of treatment for non-specific chronic low back pain.

2 AIM AND OBJECTIVES OF THE THESIS

The aim of this thesis is to make an evidence-based water exercise package to clients who suffer from non-specific low back pain.

The exercise program has as an objective to have a positive effect on factors which are associated with low back pain based on the best current evidence.

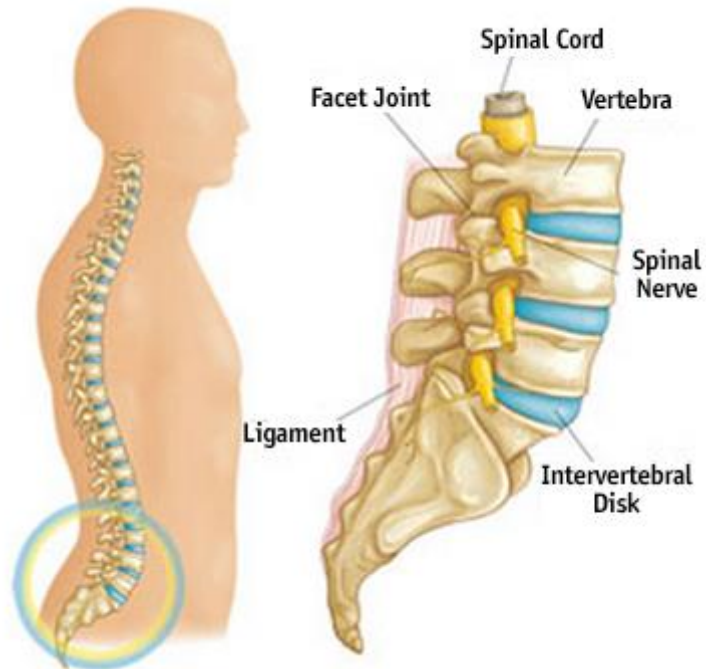
3 LOW BACK PAIN

Low back pain is the most common disease among individuals in the world regarding gender age, standards of living, or whether you live in country where medical care is provided. The WHO consider low back pain as a strong economic burden and the main reason for work absenteeism in the world. More precisely non-specific low back pain would affect between 60% to 70% in industrialized countries. (WHO, 2013.) More recently it has been estimated in 2015 that the global burden low back represents 60.1 million of people in the world so since 1994 an increase of 54% in low income and middle-income countries (Hartvigsen et al., 2018, 1).

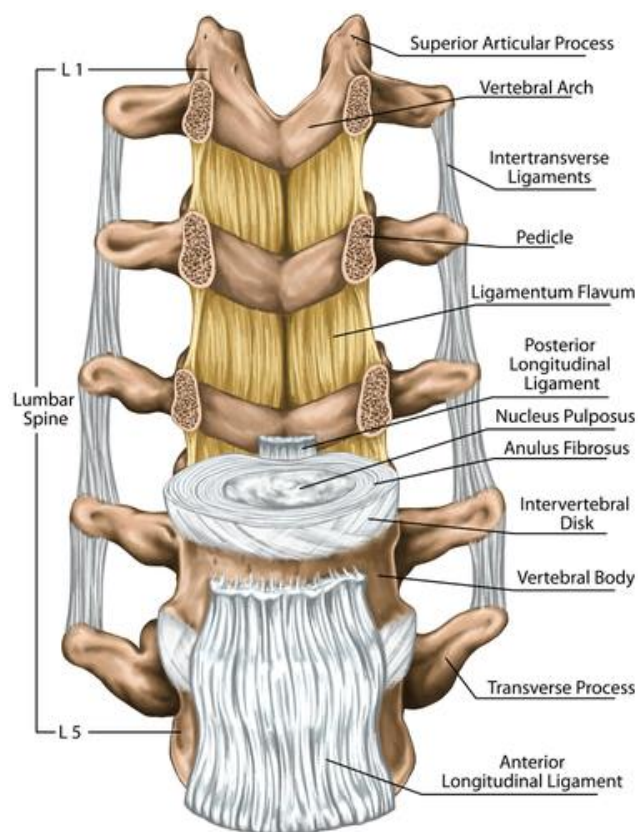
3.1 The anatomy of low back pain

Low back pain is a painful sensation located in the lower part of the spine. The spine is composed of 26 vertebrae: 7 cervical vertebrae, 12 thoracic vertebrae, and in the lower part of the back is found 5 lumbar vertebrae plus the sacrum which is the fusion of 5 vertebrae, and the coccyx also known as the tailbone (Picture 1) Each vertebrae are made of a vertebral body, inferior and superior articular process where there is an intervertebral disc between each vertebra, and an intervertebral foramen where the spinal cord passes through all the vertebrae that compose the vertebral column. The intervertebral disc is made of a central nucleus pulposus surrounded by annulus fibrosis and a vertebral endplate. Intervertebral discs are covered by ligaments anterior longitudinal which is attached to the intervertebral discs and the anterior part of the vertebral body. The ligamentum flavum which is composed of a series of elastic fibers that runs between the lamina. Posterior longitudinal ligament made of tight band

passing from intervertebral disc to intervertebral discs preventing hyperflexion of the spine. (Agur and Dalley, 2014, 21) (Picture 2)



Picture 1. Back pain in children – website of OrthoInfo – AAOS, 1995



Picture 2. Website of Ainsworth Institute of Pain Management, 2019

The role of the ligament is to connect as mentioned previously each vertebra with each other's and to provide stability to the spine, notably the anterior and posterior longitudinal ligaments which stabilize the vertebral column in flexion or extension position. Another essential part of the low back is the apophyseal joint which is a joint in a capsule covered by cartilage and lubricated by synovial fluid. The apophyseal joint has the role of control in position and posture of the spine. (Luomajoki, 2010, 11)

The role of muscle involved in stability and posture of the lumbo-sacral region could be divided according to the fact that they are deep or superficial. The most important muscles involved in posture and stabilization in movement (flexion or extension) would be the multifidus muscle which “extend from the sacrum to the spinous process of the axis”. (Agur and Dalley, 2017, 34). Multifidus is considered as one of the most important muscle in stabilization of the back in movement since it contains many proprioceptors and is involved in the biofeedback of posture and stabilization of the vertebral column. (Luomajoki, 2010, 14)

Another muscle involved in stabilization of the spine and maintain the viscera of the abdominal wall as a primary function is the transversus abdominis working in synergy with the lumbar multifidus muscle in co-contraction where the transversus abdominis maintain a neutral position of the spine and provides an efficient motor control involved in the stability of the spine. (Wen-Dien et al., 2015, 620)

3.2 Factors contributing to chronicity of low back pain

There is not often identification of reason for low back pain in term of chronic low back pain. Non-specific low back pain means that we cannot find any precise pathology such as a fracture or the result of inflammation in the lumbar region as the cause of pain. Non-specific low back pain might emerge from an accumulation of several reason, such as faulty posture coupled with fear of movement, depression, anxiety (Wong et al., 2017, 3). The fact that the cause of long duration low back pain can be multifactorial make it very difficult to identify the cause of the pain, therefore chronic pain is most of the time non-specific making non-specific chronic low back pain the leading disease in the world (Hartvigsen et al., 2018, 2364)

Among risks factors there is many which are non-modifiable like aging, genetics, or disease such as tumor, but some can be treated such as inactivity which is a risk factor leading to chronic low back pain. Genetic factor is a risk factor of chronicity of pain. A systematic review has shown that there is a complex phenotype grouping physiology, psychology and sociology where those areas had a strong genetic influence in spinal pain, and so open the path to the relation between back pain and a biopsychosocial model. (Hartvigsen et al., 2009, 1348)

Other factors that should be taken account is emotional and personal belief of the person suffering from low back pain. Fear of movement can lead to coping strategy that end in faulty movement and posture. The capacity of performing controlled movement help to keep the whole kinetic chain properly. Pain can be the reason for an altered movement pattern such as gait or keeping a proper posture, as well instability. This change in the movement pattern can be seen as a coping strategy for pain reduction, however, have on the long run a negative influence on pain due to a lack of proper use

of muscle or muscle activation. (Koch and Hänsel, 2018, 5) Those consequences can be seen as a reduced coordination or range of motion in movement and gait, with an increase in the joint stiffness (Koch and Hänsel, 2018, 6).

One of the factors that belongs to chronic pain which is commonly neglected is the social factor. Most of the time we treat pain and integrate factors related to chronic pain from a biological point of view, but it is important to integrate a bio psycho-social model such as the ICF model followed by physiotherapist. Kleiber claim that 76 percent of patients who suffers from chronic pain develop by four times risk to have depression or anxiety than those patients who do not experience chronic pain. (Kleiber et al., 2005, 14). Integrating the psychological factor where depression could be one of the reasons that initiate pain, physical activity has good effect on the reduction on the symptoms of depression as good as pharmacological treatment (Dinas et al., 2011, 322).

In that context poor living standards can reduce access to a sufficient healthcare can lead to physical disease that has an effect on long duration pain such as obesity or lack of physical activity, or emotional disease especially among older people who can suffer from depression due to their living condition, as well physical work that requires lifting, bending forward, or posture like sitting for many hours can have a negative effect on the health of the lumbar region (Hartvigsen et al., 2018, 2363).

3.3 Low back pain treatment guidelines

Talking in term of treatment related to someone experiencing pain would be naturally to use Non-Steroidal Anti Inflammatory (NSAI) drugs, however, the treatment provided by a physiotherapist is exercise, more specifically movement. It all makes sense when you realize in the case of pain localized in the Sacro-lumbar region that certain position relieves partially or totally pain, or on the contrary certain position such as bending over or lifting quit heavy items can trigger pain in low back region, or in a certain movement pattern due to a facet joint syndrome (Allegrì et al., 2016, 5).

Class A evidence recommends that the most common treatment is going to be therapeutic exercise is due to the fact that pain can originate from movement that has damaged tissue. This would be the case of acute pain where we know where the problem comes from and a diagnosis has been identifying the cause of the pain. In the case of non-specific meaning that the cause for pain occurrence is unknown and chronic, in other words for a period that is equal or longer than 3 months it is quite unlikely that pain is that a movement that has provoked tissue damage is the reason of pain. However, we know also that lack of physical activity can be associated with chronic pain, and “The available evidence suggests physical activity and exercise is an intervention with few adverse events that may improve pain severity and physical function, and consequent quality of life” (Geneen et al., 2017, 2). The adverse reaction of inactivity leading to a decrease of physical fitness in the long run, does not only affect the musculoskeletal system, but provokes a decrease in participation of activities of daily life. Occurrence is a factor that could possibly lead to depression. Lack of physical activity and decrease of physical activity are all risk factors that lead to chronic disease that are risk factors of persistent pain. (Booth et al., 2012, 68.)

The new approaches in treatment of chronic pain consider aiming at the central nervous system sensitization. Increased activity of the brain in brain's areas such as insula, anterior cingulate cortex, and prefrontal cortex are connected with emotional response known as acute pain response. These are linked as well as with cognitive factors such as fear depression known to be factors that can help to trigger pain. The reasons working on the central sensitization of patient combining behavioral therapy aiming at improving mood reducing anxiety, stress, with exercise therapy based on physical characteristics of the patient would help them to improve their health, reduce pain for a large amount of time instead of relying on pharmacotherapeutic treatment that deal with pain for a short period of time. (Nijs et al., 2019, 4)

4 PAIN

There is a lot of misconception around pain. People tend to believe that an increase in pain come from a damage in the structure of their back, that would make them more prompt to bedrest as efficient treatment, when it is in fact the opposite. The international association for the study of pain defines pain as: “unpleasant and emotional associated with actual or potential tissue damage or described in terms of such damage”. (IASP, 2012)

Pain is a vast concept that could be defined by the amount of time or type of pain, so we speak of pain as sharp, dull, burning, or aching. In order to get more clear, we categorized pain into three categories: nociceptive pain that can be sub grouped into somatic pain and visceral pain that refers to painful response due to damage in the tissue, neuropathic pain that refers to defective in the nerve cells in the peripheral or central nervous system, and idiopathic pain that refers to pain sensation with unidentified cause. (WHO, 2012, p.18-19)

Pain is the result of a brain activity. Sensory receptors called nociceptors fires a signal through the spinal cord to the brain. Those nociceptors are stimulated by the release of chemical such as prostaglandins, kinins, or potassium. (Tortora, 2011). However, we cannot minimize the concept of pain to this definition because it would mean that pain occurs only when there is structural damage. Luomajoki classifies low back pain into specific which represents 10% of cases, and non-specific which represents 90% of low back pain cases. In this non-specific group Luomajoki sub-group non-mechanical low back pain as tumors, psychological and social factors, fear avoidance, and catastrophizing. (Luomajoki, 2010, 7)

4.1 Acute, sub-acute and chronic pain

On top of definition, pain can be categorized or more specifically by its duration. In that we would talk of acute, subacute and chronic pain. Acute pain is when pain is present within 2 weeks. In acute pain the reason for pain is identified for example acute pain in lower back is due to spondylitis. It is important because with the identification

of pain as a symptom that results from a mechanical impairment, in other words it does correspond to tissue damage. “It usually has a well-defined location and an identifiable painful or noxious stimulus from an injury, brief disease process, surgical procedure, or dysfunction of muscle or viscera. Acute pain alerts us to possible injury, inflammation, or disease and can arise from somatic or visceral structures” (IOM, 2011).

Chronic pain differs quite a lot from acute pain. It is defined as a long-lasting pain (pain persists for at least 3 months) where the pathology is usually not identified, is responsive to peripheral changes in somato-sensory cortex, is also associated with depression and might be unresponsive with treatment (Courtney et al., 2017, 119).

4.2 Sensitization

Pain is a very unique experience where the threshold of pain varies grandly according individuals and their cultural background. Pain is not the highest according the severity of the injury since everyone has a tolerance towards pain but also brain is the trigger for the pain more than the injury itself (Apkarian et al., 2011, 7). In the specificity of chronic pain, multiple scan revealed that that changes in the brain appeared during experiencing pain, more precisely in the medial prefrontal cortex which is the zone of the brain known for regulating emotions that correlates with low back pain (Apkarian et al., 2011, 7).

Our latest understanding of pain led us to look at the plasticity of the brain and pain. The plasticity of the brain is the capacity of the brain to change and adapt according the previous experience of individuals. Neurons located in the brain order to release excitatory chemicals that neurons situated in the spinal cord will adapt to those changes which will have as consequences to amplify the pain signal due to the increase of the sensitivity. Increased sensitivity that makes the pain signal stronger is known as allodynia, but also the pain things that didn't trigger pain before now does, it is a phenomenon called hyperalgesia. (Butler and Moseley, 2013, 7)

The brain in these circumstances receives wrong information about the real health status of the tissue because of that increased sensitivity, and the longer the pain is

happening, the more changes in the brain happens. This pain signal gets stronger inputs because the neuroplasticity enhances the emotional experience of pain, as a learning experience through the memory of each individual pain experience suffering from chronic pain. In these conditions, pain related to cortical activity end into chronicity of pain. (Mansour et al., 2014, 5)

5 AQUA THERAPY

Hydrotherapy is a type of therapeutic exercise where the individual is immersed in water. Most frequently, water exercise is performed in a therapeutic pool where some specific conditions are observed such as the water temperature which is around 28 to 30 degrees Celsius maximum for the reason that it facilitates muscle relaxation and stretching, and is the most comfortable temperature to perform water exercise at moderate intensity. (American Red Cross Scientific Council, 2013,1)

5.1 Use of water and pain

The reason to exercise in water is that the water element has properties that can help individuals to perform movement that would be difficult on land such as pain. There are different types of use of water as therapeutic treatment. Some are referred as balneotherapy, other as hydrotherapy also called aquatherapy. Balneotherapy differs from hydrotherapy in the sense that balneotherapy is using thermal mineral water and also using specific gas such as iodine or CO₂ as a medical treatment. Aquatherapy consists of exercising in the water element, usually a therapeutic pool. A meta-analysis show that there is not evidence with water exercise being more efficient than land-based exercise, however, narrative many reviews indicated that minor improvement from a water-based exercise program occurred in pain reduction as well as ameliorating symptoms of depression. Carbonell-Baoza et al., 2012, 2)

The most common reason to use water element properties is the effect it has on pain. A recent study working with patients suffering from fibromyalgia received hydrotherapy

treatment and argued that the water works as thermal receptor that increases the sensitivity of thermo- and mechano-receptors while the pain receptor known as nociceptor activity is blocked. Water works in that way as a natural analgesic. (Zamuner et al., 2019, 1972). But not only the water temperature has properties that can be exploit in therapeutic exercises, water element does present several conditions that makes it an ideal environment for exercising. (Lawrence Debbie, 2008, 2)

5.2 Buoyancy

The reason to use to water exercises is to use the property of water. The water element can help to perform resistance movement even without any equipment to keep afloat, and where the viscosity of the water help you to realize movement in any directions, where exercises on land would be difficult for person suffering from musculoskeletal disorders or pain that would limit movements. (Bidonde et al., 2014, 8)

What makes water-aerobic preferable than exercising on firm ground is the fact that water can act as counterbalance towards gravity. More specifically, the density of water is based on Archimedes principle meaning that human body immersed in water float. Based on that principle, it has a positive impact on joint, and can beneficial for people suffering from obesity or having pain in the joints. (Torres-Ronda et al., 2014, 238)

A summary of systematic reviews based on Randomized controlled trials conducted by Hiroharu Kamioka emits the possibility that the temperature of water and also the buoyancy might have an effect on pain reduction by blocking the nociceptive signal transmitted by the thermo- and mechanoreceptors, and so having an influence on the several structural elements of the spine. (Kamioka et al., 2010, 2)

5.3 Hydrostatic pressure

Another aspect of exercises in water element that makes it more interesting than on land-based exercises is the benefit of hydrostatic pressure physiological response on the human organism. The hydrostatic pressure will help to get an increase the cardiac

output, blood circulation into muscle, help with the metabolic waste due to catabolism and anabolism from muscle to the blood, and also reduce the time necessary to carry oxygen, nutrients and hormones to fatigued muscles (Torres-Ronda et al., 2014, 241).

Another benefit of the hydrostatic pressure on human physiology is that water act as a compressor on chest and so help to improve the lung capacity. The compression on chest wall more specifically the abdomen naturally rises the diaphragm and get into a position that is closer to a full expiration reducing the workload of lungs (Torres-Ronda et al., 2014, 241). There is moderate to strong evidence putting in correlation the respiration and postural control of the spine as a possible source of pain in the low back region. The relationship due to lack of core stability and non-specific chronic low back pain are linked resulting from poor control of the core muscle and have a negative impact on the core muscle activation control, breathing patterns, and proper use of the mechanisms of the diaphragm. (Anderson and Bliven, 2017)

The viscosity of the water add resistance, which help to perceive our body and movements and so, provides a better recruitment of motor units and their synchronization due to the resistance of the water that reduces the velocity of body movement in immersion. (Zamunér et al., 2019, 1972)

6 LOW BACK PAIN ASSOCIATION

The water exercise program has been designed for physiotherapist who work for the back association of Satakunta (Satakunnan selkähdistus). The back association of Satakunta has been created in 1997 and is held and managed essentially by volunteers. The different person who intervene within the back association are physicians, physiotherapists, nurses, health care practioners, masseurs, or others who would to contribute to provide help toward back care and well-being. (Website of Satakunnan selkähdistys, 2017)

The aim of the association is to deliver and make information accessible and to provide care, rehabilitation or preventive physical work. Every tuesday and thursday the back association send a health care practitioner such as physiotherapist to organize and guide water exercise. Lectures are organized once a month by professional regarding low back pain. Lectures are free and open to the members of the back association. (Website of Satakunnan selkähdistys, 2017)

7 THERAPEUTIC EXERCISE

Therapeutic exercise is not to be misunderstood with physical activity. The WHO defines physical activity as movement of the body produced by the musculoskeletal system that expends energy, when exercise is seen as a “subcategory” of physical activity which is organized, repetitive with the goals to improve and or maintain one component or more of physical fitness. (website of the WHO, 2018)

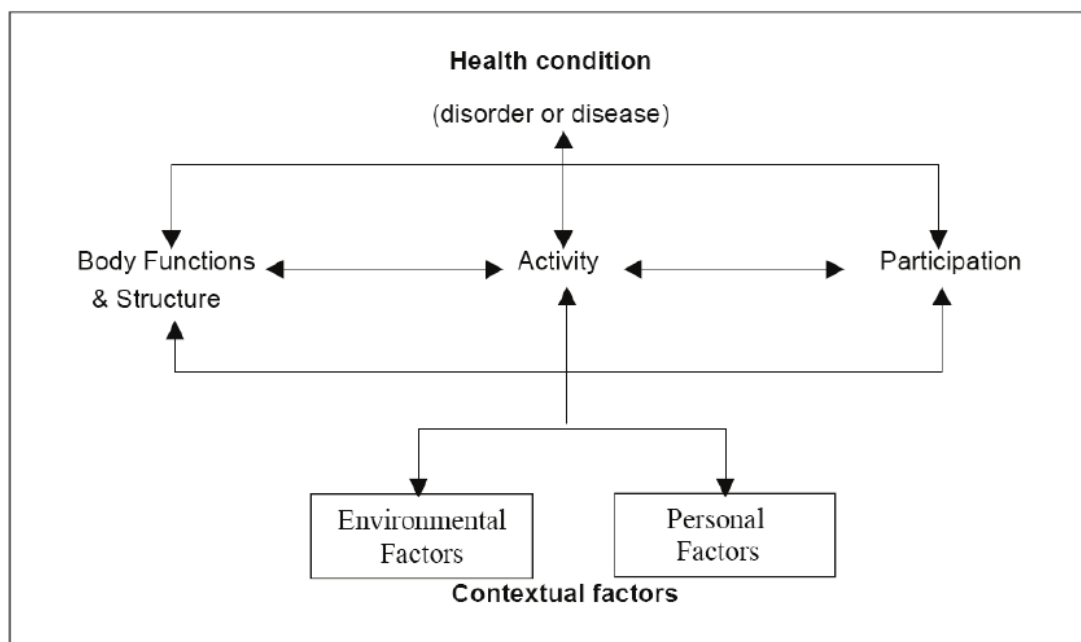
7.1 Basic principles of therapeutic exercise

As described previously, therapeutic exercise aims to improve or maintains the level of physical fitness of individuals. This involves that it is prescribed by a health care practitioner who designed a specific plan based on the issue and characteristics of the client that is ensured by the Health Care Professionals Act (Valvira, 1994).

The benefits of therapeutic exercises and primary objective is to allow client to rehabilitate or prevent eventual impairment, to ameliorate or restore body function such as balance, neuromuscular control, mobility/flexibility, muscle performance, stability, and cardiopulmonary function (Kisner and Colby, 2012, p.3.)

Therapeutic exercises are based on the ICF model (figure 3) that is perceived as a bio-psycho-social model that encompasses functioning and disability and the contextual factors. The functioning refers to the impairment related to the body structure and

body's function and the capacity to participate in Activities of Daily Life (ADL). Disability is seen as dysfunctioning of body function or body structure that leads to activity limitation such as dressing or bathing and participation's restriction such as working or practicing leisure and physical activity. The contextual factors are embedded with environmental factor such as access to facilities or assistive devices in terms of care and rehabilitation, and personal factors that are the factors related to gender, age, social background. (Website of WHO, 2002)



Picture 3. The ICF Framework, Kisner and Colby, 2012, 5)

7.2 Benefits of therapeutic exercises

Physical activity and exercise are recommended on national level guidelines. There is strong class A evidence that there is many beneficial reasons to regularly practice physical activity and/or exercise reduce considerably risks of cardiovascular disease, stroke, hypertension diabetes type II, metabolic syndrome, obesity, cancer, depression, and maintain or improve level of function and cognitive level of people. (ACSM, 2014, p.9)

There is class A evidence therapeutic exercise has a positive impact on overall health fitness of individual, but also shows that therapeutic exercise is efficient in the reduction of pain and symptoms of depression. A recent review and meta-analysis showed strong evidence that exercise had a good effect with people with fibromyalgia in the reduction of symptoms of pain, and in reduction of symptoms of depression. (Sosa-Reina et al., 2017, 13).

In treatment of pain, more precisely in non-specific chronic pain, depression is one of the factors that contributes to long duration of low back pain and improve mood in general. aerobic exercise training has similar effect than standard anti-depressant medication. (Blumenthal et al., 2007). One of the hypotheses is that release of β -endorphin during exercise, which is an hormone produced by the pituitary gland in response to stress element like pain. The release of that hormone has a beneficial impact on mood and improve the well-being in a more general concept, when one of the other hypothesis talk about the monoamine hypothesis which argues that exercise increase the capacity of neurotransmitters such as serotonin, dopamine or norepinephrine with regulates the mood and has good effect on depression. (Craft and Perna, 2004, 107-108)

Therapeutic exercise is not only involved with rehabilitation but can also be a part of prevention. This implies that practioners in the field of health care and wellbeing should provide consistant exercise based on the mechanisms, risks factors, and risks for recurrence of low back pain and explain regular physical activity and exercise are beneficial for people. (Shipton, E, A, 2018, 128)

7.3 Therapeutic exercise in chronic low back pain

There is no evidence available that shows that there is exercises better than other in the treatment of low back pain, or that individual programs are better than group exercise program. Muscular strength program of the deep abdominal is considered among as the most effective treatment to regain including functional ability like walking speed, because of the involvement of core muscle in gait. Improvement in muscle strength and endurance of the trunk muscle. (Shnayderman and Katz-Leurer, 2012, 212)

Treatment of non-specific chronic low back pain that are proved efficient in pain reduction cannot be based only to simple treatment such as ultrasound, hot/cold temperature, or massage if not coupled with exercise. Resistance training and coordination/lumbar stabilization exercise targeting essential core muscle involved in the stability of the trunk, such as transversus abdominis and multifidus muscle shows significant results concerning reduction in pain. (Searle et al., 2015, 1163)

Among the literature review we can find conflictive results regarding what type of therapeutic exercise is the most effective in treatment of low back pain. However, studies reveal that strengthening and lumbar stabilization have good results on the overall health status, but also are recommended exercise that help to relieve low back pain and increase the muscle endurance, where stabilization exercise such as the McKenzie approach also called the Methodical Diagnosis Treatment (MDT) shows better results in pain reduction in chronic low back pain when results of lumbar stabilization did not show superior results in reduction of low back pain than other type of intervention in treatment of low back pain (Lam et al., 2018, 485). A recent randomized controlled trial measuring the effectiveness of the lumbar stabilization compared with dynamic strengthening and Pilates exercise showed that the group following lumbar stabilization had better results in reduction of symptoms of pain due to the drawing-in maneuver which facilitates a co-contraction of the transversus abdominis with the multifidus muscle improving coordination work with global muscles. (Bhadauria and Gurudut, 2017, 482)

7.4 Method of delivery

The European guidelines for the management of chronic low back pain states that there is very few evidence that can conclude what types of exercise therapy is the most effective in term of treatment of non-specific chronic low back pain, but see exercise therapy as a method that should be left to the preferences of the person and recognize group exercise therapy as an appealing method to take care of a large number of person suffering from non-specific chronic low back pain. (Airaksinen et al., 2006, 237-238)

Therapeutic exercise can be design in many various forms such as individual exercise, group exercise, land exercise or water exercise. Literature review do not show strong evidence that hydrotherapy is a better method of therapeutic exercise than land-based exercise, but there is good evidence that hydrotherapy is an efficient type of therapeutic exercise for patient suffering from chronic low back pain, especially for those who would improve difficulty to perform therapeutic exercise on land, water exercise would be a good alternative at the beginning of the treatment, and water exercise due to the properties of the water element offered an effective way to activate contraction of the muscle targeted. (Psycharakis et al., 2019, 307)

8 IMPLEMENTATION

The implementation of the exercise program has been agreed to happen once a day every Tuesday or Thursday on a period of 4 weeks. The number of participants can vary from a session to another but been established to 10 participants. All participants are women aged from sixty years old or over. Basic information on age of all the participants has been communicated and cannot be expressed.

The whole session is composed of three different parts: warm-up, main treatment part that focuses on core muscles and pelvic region and cool down by stretching movement. The whole session is will happen in 45 minutes. The warm-up is lasting 10 minutes for the reason that the warm-up is to perform mobilization of all joints and increasing body temperature by active movement.

Warm up diffusion and circulation of synovial fluid in joint capsule, and increase temperature of body, muscles ligaments and tendons will prevent injuries, and increase of heart rate that lead to increase of blood flow to the muscles and enhance the distribution of oxygen in muscle cells. (Lawrence Debbie, 2008, P.86)

The warm-up is focusing on the main muscle group of the body: pectoral muscle, deltoids, trapezius, rhomboids, biceps and triceps brachii muscle, quadriceps, hamstring

and calf muscle (gastrocnemius and soleus), the abdominal and hip muscle. It is important to warm up the muscle around the pelvic girdle, for the reason that the second part of the exercise program will focus on this region and has the goal on performing the movement in a correct manner and focus as well on the feeling of the contraction of these specific muscle, and the movement control.

The second part of the water exercise program is focusing on the muscle activation of that are usually solicited in treatment of low back pain in therapeutic exercise. It happens for a duration of 10 minutes and is repeated a second time, so in total the main part of the water exercise last for a period of 20 minutes. There are seven different movements focusing on low back and pelvic girdle and are performed with a pool noodle to add resistance in water and so help the participants to feel the muscle activation which is wanted. (Appendix 1)

The use of pool noodle also provide a better focus on the motor control of the movement and keep the spine in a neutral position and provide a focus as well on the spine stability due to the activation of the core muscles involved in stabilization of the spine. The use of pool noodle also offers an interesting additional resistance into water and provide a supplementary effort on balance. Learning to feel the contraction of the muscle targeted and using small resistance to improve motor control would help to increase the perception the position of your joint and the stabilization of the vertebral column and its different element such as muscle or joint without being aware of it. The idea is working on these different components of possible triggers of low back pain, you would gain a healthy posture of your spine and reduce the experience of pain in the lower back. The water element can add some resistance according the velocity of movement performance, which is the reason why the speed of the movement execution is not a fast execution of the movement. The aim is not to focus on the strengthening of the core and lower limbs, but to focus on the muscle activation which are targeted, and on the motor control which is the capacity to achieve a certain pattern of movement. The fact to focus on the core muscle and notably the obliques and transversus abdominis and multifidus muscle.

The last part of the session is a cool down composed of different stretching movements for the whole body. Each stretch last for a period of time of 30 seconds per muscle

targeted. The reason for stretching at the end of the session help the cardiac rhythm to come back to normal after exercising and facilitates muscle recovery. (Lawrence Debbie, 2008, p.107)

Questionnaire at the end of the implementation will be submitted to participants to get results concerning their experience related to the water exercise they performed. (Appendix 2)

9 DISCUSSION

All along the thesis process came challenge that had to be overcome. I had very little experience about water experience and I had to develop my theoretical knowledge about hydrotherapy in order to develop an exercise program that is proved relevant by the physiotherapist that is supposed to use it. I had the opportunity to assist to one of the sessions made by the physiotherapist that gave me insight of how is conducted water exercise with client suffering from chronic low back pain. The fact that I have assisted to one of the sessions that is usually performed was a good opportunity for me to meet the participants of the Satakunnan selkäyhdistys. I discussed further on with the physiotherapist about the physiognomy of the group to know how many participants are present usually, and if there are movement restrictions, I should be aware, and then I have discussed about the concept of the exercise I want to perform with this specific group. I have discussed about the benefits of core stabilization of the exercise, and the muscle targeted and their connection with core control and the stabilization of the pelvis and deep abdominal muscle involved as a treatment related to low back pain. The main concept was to implement core stabilization exercise adapted into water-based exercise.

One of the difficulties came from the fact that the therapeutic pool that is used is quite small for the number of persons in water. Traditionally, water exercise program is done in swimming pool where the length of the pool is around 25 meters and then provide enough space for all type of movements. The narrow space offered by the pool in use did not allow any movement that requires a lot of space such as jumping from one side

to side. Challenge that occurred during the implementation was also that I had to take into account that water temperature exceeds the regular water temperature in therapeutic pool which is between 26 to 28 degrees Celsius. The water there was almost 30 degrees Celsius. The fact that the temperature is above regular increase the body temperature very fast and has an effect on the cardiorespiratory system and on the endurance capacity. For all these reasons, the decision to perform movement in a static position has been decided to overcome the problem of space, and to keep exercising on the targeted muscle at a low intensity that keeps the whole session comfortable for the participants.

For ethics reason, decision to design the exercise program for the physiotherapist to use it later on with the participants. The reason to use a questionnaire was not to obtain a score, or interpret results, but to make a survey about how the customer felt going along with the exercise program and measure the level of satisfaction of the participants who experienced the water exercise program.

It is designed as a subjective questionnaire where the participants of the exercise program answer in a first part about specific question about themselves such as age, gender, and professional activity for those who are not retired. The third question is focusing on the level of physical activity associated with the profession of the person who could represent a risk factor due to lack of physical activity related to profession such as office worker or professional activity that involve repetitive lifting movement that could represent a risk factor for chronic low back pain.

Another part of the questionnaire is asking questions that would eventually put in relation the lifestyle and risk factors related to the low back pain the participants can experience.

The main problem I have been confronted was the difficulty to engage with clients to discuss further about the exercises. The availability of the client was very little, and discussion with the client happened only three times over the implementation of the exercise program. The lack of communication has disrupted the thesis process especially the questionnaire that has been designed to evaluate the level of satisfaction of the clients regarding the exercise program and its possible effect on low back pain

experienced from the participants. It is impossible to conclude anything since the questionnaire has not been returned and no analysis are available.

During implementation of the exercise program, I had to discuss with different interveners who guide water exercise who are not physiotherapists which was difficult to get feedback on the pertinence of the different exercise targeting specific muscle in the frame of rehabilitation, but was a good opportunity to educate on the main exercises as treatment of low back pain in the context of physiotherapeutic rehabilitation. I experience challenges as I experiment myself with the participants since availability of the third part has decreased a lot along the implementation process, and guiding exercising in Finnish was relatively easy since it has been done in command style with visual demonstration of the movements on the exercise program. However, Some of the participants see the aquatherapy séance as social event and enjoy talking during the session, and composed a challenge to keep this setting of relax, chatty atmosphere in Finnish, which for some of the participants represents a social and psychological aspect of the water exercise.

No conclusion can be achieved from the implementation due to the lack of contact and feedback from the third part and regularity of implementation of the exercise program, even if the participants gave as verbal feedback that they were satisfied, felt the really well muscle targeted, and had a feeling that pain reduced. To get more concrete reliable results, implementation should be done again with evaluation of satisfaction questionnaire should be done at the end of the 4 weeks of using this program. If questionnaire would have been returned, it would be interesting to based on the level of satisfaction of clients was positive to analyze further the impact of stabilization exercise in water.

Answers from questionnaire related to movement would be utilized to determine which movement felt the most challenging to perform in the goal of make eventual changes to personalize the exercise program specifically to that group, and would be a good indicator if the water exercise program is successful in the aim of having an effect on the level of pain and amelioration of quality of life according the participants. Interpretation of the answers related to the questionnaire would be used in the aim of possible amelioration of the exercise program would be based on the sensation felt by participants. Was it too difficult or too easy? Did you feel the contraction of the muscle

targeted? Based on the responses of the participants it would be easy to know if the exercise program was a success, and if so, what movement felt the most enjoyable to perform, what movement felt unpleasant or too difficult. Continuation of the exercise program could be done in the aim to measure the effectiveness of the exercise program on low back pain reduction and better quality of life.

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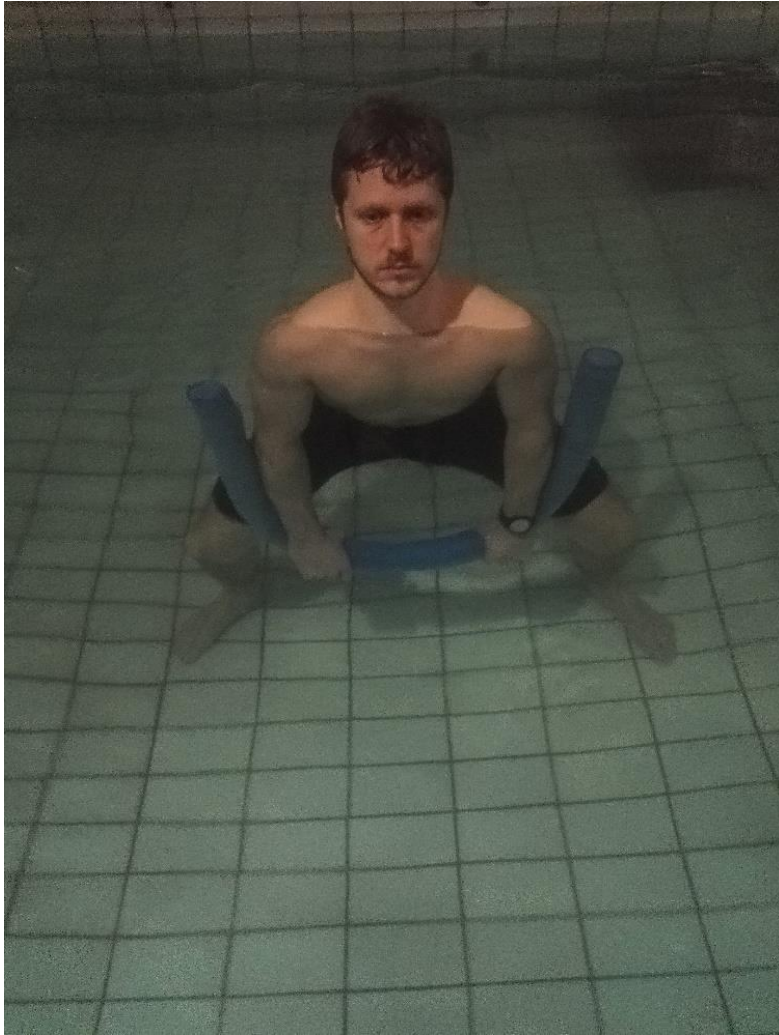
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APPENDIX 1

The first movement is a mini squat with the help of a pool noodle. You keep the pool noodle down in water your back in a neutral position. Keep the pool noodle in your hands with arms extended. You bend your knees slowly with your feet slightly outward and a bit wider than your hip. The aim is to strengthen the hip joint and the thighs working in coordination with abdominal muscles and low back muscles. In this exercise it is important to execute the movement at a slow pace focusing on the contraction of the abdominal in the descent. Before movement execution you have to engage your core and focus on the transversus abdominis activation. The multifidus muscle will be put in contribution as well that work in co-contraction which maintain the and provide spine stability and protect the force that applies on the intervertebral disc. This exercise maintains the strength in your quadriceps, but also as a therapeutic affect working on the motor control, balance, coordination and proprioception.



The second exercise is jumping side to another side. In this movement, you bring your knees together up toward your chest or as close of your chest as you can and extend your legs aside and repeat the same procedure to the other side. You can sit on a pool noodle to facilitate your position and keep your balance. This exercise target primarily the external and internal oblique muscle. This movement targeting the external and internal oblique work on the stabilization of the spine because of their attachment to the thoracolumbar fascia.



The third movement is to bring the pelvic girdle up and down. To perform this movement you hold the pool noodle between your knee flexed at 90 degrees. Then get into a sitting position and stabilize your position with the pool noodle. Then knee together bring your knees up toward your chest and back into a neutral position at the hip joint. This exercise work on the core abdominal muscle. To increase the work on the core muscle you can bend forward in a semi supine position. The challenge of this exercise is to maintain your balance while having the pool noodle into water which add additional resistance. You have to focus on the good execution of the movement and

improve your sensory motor control. Using both legs at the same time work on the coordination and work on delay muscle activation and so disturbed muscle movement due to impaired muscle recruitment.



4. Straight leg hip flexion with pool noodle

The next movement is a straight leg flexion in a standing position. You place the pool noodle in front of you with arm extended. Bring your foot leg extended at the knee joint as much as possible to the pool noodle. The exercise is usually used in prone position to assess tightness in hamstring due to compression of sciatic nerve or possible disc herniation. This as well an efficient way to work on the mobility of the hip joint and to improve the stability of the core. it will develop muscular reinforcement in the obliques. By bending forward there is small contraction of rectus abdominis and transversus abdominis that help the stabilization of the spine and prevent posterior pelvic tilt. The water element help to perform this movement by reducing the gravity. The resistance added by the velocity of the movement force is a good reminder to the person to perform the movement in a slow manner and so to focus on the muscle involved in this movement. It also provide spinal decompression by stretching the spine and alleviating the pressure from the disc and vertebrae.



5. Stepping with pool noodle

To perform this exercise, you will stand with your spine in a good neutral position. You will place the pool noodle under your foot. Keep your core muscle engaged and bring your knee up flexed at 90 degrees. The idea of this exercise is to improve stability into the pelvic girdle and focus on the core muscle activation. The difficulty of this exercise is to be able to keep your balance while lifting your knee up. To do so you will have to slowly bring your knee up and focus on the feeling of the core muscle activation. The difficulty is increased by the keeping the pool noodle under the foot. The float add more resistance while the foot is lifting up from the ground, but help to feel the contraction of the transversus abdominis. It does solicit the gluteal muscle as well on the supported leg that maintain the balance of the body and improve pelvic stability because the gluteal muscles is considered as a stabilizer for the pelvic girdle

since the main function of the gluteus maximus extend the hip joint and assists in external rotation and steadies the lower limb and provide support in raising the trunk, while the gluteus medius and medius rotates internally the hip joint and maintain the pelvis in a correct position in gait while the opposite leg is lifting off the ground till the swing phase.



6. Torso rotation with pool noodle

The next movement is a rotation movement of the trunk. To do so you need to get in the warrior position which consist of putting one leg behind you straight on toe, the other leg flex at the knee joint with full contact of the foot on land. Then bring one leg in front of you with pool noodle under water or at the surface applying force toward

water as a support. Twist the rest of your body where the other arm extended lead the twisting movement. Rotate to

The aim of the movement is to activate the obliques muscle involved in spine stabilization primarily but also the transversus abdominis that work as a main stabilizer muscle of the spine. The interest of this movement is that it does stretch the thoracolumbar fascia which is attached directly to the obliques and the transversus abdominis. This stretch relieve pressure and improve mobility in spine.



7. Side bend with pool noodle

The last movement consists of a lateral flexion with pool noodle. In this exercise you'll have to engage your core, keep a neutral position of the spine, with a pool noodle in your hand arm extended and flex laterally to the side of the pool noodle. Repeat this movement on the other side.



Appendix 2

1. Gender:

Male

Female

2. Age: 50-60

60-70

70-80

80-

3. Profession:

Retired

At work

Profession:

4. Level of physical activity:

Low: I usually stay at home and walk less than 15 minutes a day. I avoid stairs, and I have hobbies such as gardening

Moderate: I usually walk 15 to 60 minutes per day, and I participate to physical activity groups in addition to water aerobics

High: I walk more than 60 minutes per day, I practice physical activity such as biking or swimming

5. For how long have you experienced chronic low back pain?

6. How long have you been taking part in water aerobics?

7. What are the main reasons to participate in water aerobics?

8. How many times have you done the water exercise programme that focuses on the low back and core muscles?

9. Is there a movement in the exercise programme you like the most and why?

10. Is there a movement in the exercise programme which does not feel good and why?

11. Do you feel improvement in your low back region since you started the exercise programme?

12. How about in your range of motion?

13. Since participating in the water exercise programme, did your level of physical activities increase decrease remain the same?

14. Do you have any comments or suggestions about the exercise programme?

