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# **Influence of physical activity on body and mind until 1 year postpar- tum**

Independent learning material for physiother-  
apy students

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## ABSTRACT

Cukure, Ruta: Influence of physical activity on body and mind until 1 year postpartum

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Physical activities in postpartum period are essential for a healthy rehabilitation for women' body and mind, at the same time helping to adjust to the new lifestyle. Yet, there is a lack of education given to women about the benefits of physical activity from health professionals. This thesis combines various methods and approaches that can be used from physiotherapeutic perspective in postpartum period.

The aim of the thesis is to introduce graduating physiotherapy students of SAMK about the importance of physical activity in postpartum period educating on physical activity influence not only on the body but also the mind. The objective of the thesis is to provide a study material on H5P platform about the topic that can be used in lectures as self-study method.

This action research-based thesis contains theoretical and practical part. The process began with collecting information and analysing its accuracy, followed by more practical approach by providing examples of physiotherapeutic methods that can be done in postpartum period. In addition, study material on H5P platform was done.

Keywords: physical activity, postpartum, guidelines, physiotherapy, psychosomatic physiotherapy

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## 1 INTRODUCTION

Pregnancy and labour are natural yet life changing events that challenge woman' body and mind to new limits bringing a new appreciation to what it can go through and how it can heal. Postpartum period deserves proper and equal postpartum care that involves education, regular health check-ups, assessment of possible post pregnancy related health conditions as well as general well-being of mental and physical state. (Critchley, 2022)

Physical changes that occur during pregnancy and postpartum involves anatomical changes as well as musculoskeletal, endocrine, respiratory and other body systems. Pregnancy requires for the body to adapt quite quickly to be able to bear weight, adjust in alignment of the pelvic bones and joints in addition to increased lumbar lordosis in later stage of pregnancy due to change in centre of gravity thus providing better stability and balance. (Morino et al., 2019)

Return to pre-pregnancy state require time and effort which explains why moral any physical support from partner and family is needed. Rehabilitation period may take time nevertheless there are several approaches and therapeutic methods that can be done already at the very beginning to ease postpartum period. Physiotherapy methods include therapeutic approaches physically as well as psychosomatic modalities. The combination of both creates a possibility to achieve better results to treat weight gain, depression, insomnia and anxiety, improve muscle strength, endurance and overall well-being. (World Health Organization, 2022)

## 2 AIMS AND OBJECTIVES

AIM – Introduce physiotherapy students of SAMK about the importance of physical activity in postpartum period educating on physical activity influence on inseparable body and mind connection.

Objective – Create a self-study material on Moodle H5P platform to inform students about the recovery of mind and body postpartum, providing with practical methods and approaches that can be used.

### 3 ANATOMY AND PHYSIOLOGY OF FEMALE BODY PRENATALLY

The anatomy of pelvis consists of three main bones – pubis, ischium and ilium and sacrum, coccyx posteriorly. It is located at the centre of the body connecting trunk to legs. Female pelvis is described as wider and shallower as well as thinner and lighter than male due to females' ability to carry foetus and use pelvic outlet during parturition. (Agur & Dalley, 2013, pp. 199–203) Ilium bone articulates posteriorly with sacrum through sacroiliac joints forming a great stability for pelvis. It is important to understand that there is greater (pelvis major) and lesser pelvis (pelvis minor), where the lesser is considered as true pelvis and plays important role when foetus is born vaginally. (Schuiling et al., 2017, pp. 77–78) In females pelvic cavity contains reproductive organs such as uterus, fallopian tubes, ovaries, upper vagina as well as urinary bladder, rectum, anal canal and other. Uterus sits at the centre of the pelvic canal. (McEvoy & Tetrokalashvili, 2019)

To understand the importance of pelvis during pregnancy and postpartum, pelvic functions needs to be addressed. The main function of pelvis is to bear weight of the body and transfer loads that are generated by bodyweight and gravity during everyday life activities. Understandably, during pregnancy the weight increases, and pelvis is under more stress and requires balanced alignment position. Pelvic alignment is changing during pregnancy and postpartum due to reasons of hormonal changes, musculoskeletal changes failed load transfer. Therefore, it can cause low back pain, pelvic pain, sacroiliac joint pain and instability, pubic symphysis pain as well as urinary incontinence due to anatomical changes of pelvic floor. (Morino et al., 2019)

Pregnant women encounter changes in centre of gravity due to expansion of the uterus. To be able to counterbalance the weight, women tend to develop lumbar lordosis, which is an increased inward curve of lumbar spine. Such occurrence can cause low back pain and lengthening of hip flexors. (Jordan et al., 2018, pp. 44, 216) In addition to foetal growth and change in the centre of

gravity, anterior pelvic tilt is a common aspect of pregnancy. Noticeable pelvic tilt remains tilted forward for some time even after birth. Latest studies shows that anterior pelvic tilt is connected to pelvic pain during pregnancy and clinicians should be taking that into consideration when encountering such situations in working life. (Morino et al., 2019) Moreover, to lower spine lordosis, there is also a possibility of increased thoracic kyphosis due to enlargement of breast tissue causing stretch of rhomboid and other upper back muscles and shortening of pectoral muscles. Mentioned changes can cause spinal instability as well as rounded protracted shoulders. (Segal & Chu, 2015) Figure 1 presents all the changes in spinal curvatures, pelvic and knee joint alignment, change in centre of gravity and head posture.

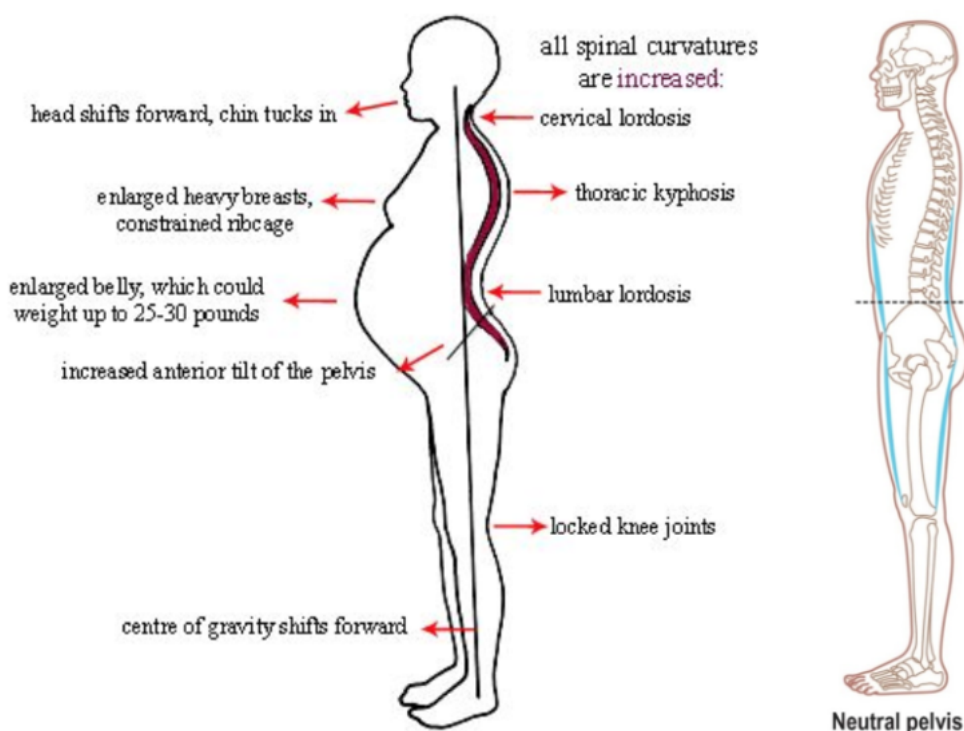


Figure 1: Postural changes in pregnancy (Bui, A. 2023)

One of the most essential parts of daily life is walking that plays an important role of controlling weight gain during pregnancy. During the prenatal period, women's body is experiencing change in centre of mass that greatly affect the balance and gait. To be able to continue walking and maintaining the balance,

women widen the stance and as well as decrease the stride length. Although the situations are very individual, article did not prove great changes in walking velocity similarly like other studies. (Gilleard, 2013)

Respiratory system provide oxygen for the whole body and pregnancy creates changes anatomically and physiologically. Understandably, due to the size of uterus, structures around the abdominal and thoracic area are altered. During pregnancy and growing uterus, diaphragm muscle which lays below the lungs is pushed upwards for 4-5cm. Diaphragm reposition causes reduced FRC (functional residual capacity) which is an amount that stays in the lungs after normal passive expiration. ERV which is an active forceful expiration is also reduced. Breathing frequency is increasing as well as tidal volume which is the air that circulates in each respiratory cycle. Further on, the ribcage is expanding, especially the lower ribs allowing the uterus to grow. Some women experience rib pain due to different rib location pulling the surrounding tissues. (Lo-Mauro & Aliverti, 2015) In Figure 2 size of uterus throughout the pregnancy is displayed.

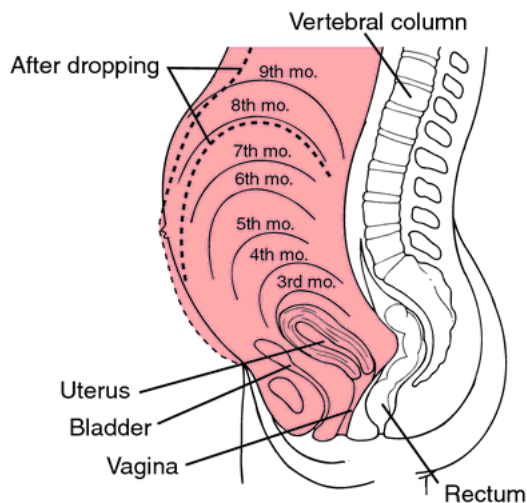


Figure 2: Uterine size in pregnancy (New kids Center, n.d.

<https://www.newkidscenter.org/Uterus-Size-During-Pregnancy.html>)



### 3.1 Musculoskeletal system

Musculoskeletal system undergoes a great number of changes during pregnancy and has influence on the postpartum period and recovery. To understand that, it is needed to explore the main areas and structures of women's body. Pelvic floor, abdominal wall is impacted widely, although from changes occurring in these areas, other body parts are also involved. Pelvic floor muscles, ligaments, tendons and other structures are built in a complex layered system serving multiple functions, mechanisms for human functioning. Pelvic floor consists of many muscles that is considered to be structured in superficial and deep layers.

“[...] the superficial muscle layer and the muscles relevant to the anal canal function are the external anal sphincter, perineal body and possibly the puboperineal (or transverse perinei) muscles. The deep pelvic floor muscles consist of pubococcygeus, iliococcygeus, coccygeus and puborectalis muscles. In fact, puborectalis muscle is located in between the superficial and deep muscle layers, and it is better to view this as the middle muscle layer of the pelvic floor.” (Raizada & Mittal, 2008)

For a body function completely and healthy, muscles of the trunk, lumbar and sacral regions must be activated to perform regular everyday tasks by twisting, turning, maintaining the posture, and even sneezing and coughing. Muscles surrounding, per example, adductors, gluteal compartment, respiratory diaphragm should activate simultaneously. This can be done thanks to myofascial continuity that connect all the mentioned areas. (Bordoni & Leslie, 2019) To connect all the muscles to bones and bones to bones, tendons and ligaments are needed. Articulations that are found in pelvis are between sacrum and coccyx, also between sacrum and each ilium, and between the pubis bodies forming a fibrocartilaginous disc. (Chaudhry et al., 2022) During pregnancy pelvis is exposed to multiple changes, per example, joints become looser due to hormone called relaxin activation. Pubic symphysis and sacroiliac joints widen in order to provide larger space for delivery. The width in pubic symphysis can increase from 3-5 cm before pregnancy to 5-8cm during. All of these changes are essential and play a big role preparing the body for labour and during it. Pubic and sacroiliac joint pain is a common occurrence sometime during pregnancy. (Segal & Chu, 2015)

There are several changes occurring to musculoskeletal system during pregnancy that can influence the women's experience carrying a child. One of the side effects can be carpal tunnel syndrome which is caused by the compression of median nerve due to excessive amount of body liquid. Symptoms usually are tingling and/or numbness sensation but can be asymptomatic. Moreover, to fluid built outside the cells, it can cause oedema. Most often, the fluid is found in lower limbs later in pregnancy due to extra weight from uterus, interfering with venous return. (Jordan et al., 2018, pp. 220–222)

### 3.2 Endocrine system

Endocrine and metabolic changes during pregnancy are vital and there are several important hormones that play an important role in supporting placenta, foetus and women itself. In this chapter multiple hormones will be discussed in closer to understand their activity, significance and effect. In figure 3, it is seen how the hormones fluctuate throughout the pregnancy and how they return to pre-pregnancy state after delivery.

To start with, one of the first pregnancy hormones being produced is human chorionic gonadotrophin (hCG). Its production is made by placenta in early pregnancy. This hormone usually tests the existence of pregnancy using the tests bought in pharmacies and stores. Hormone stays in the body throughout the whole pregnancy, but the peak of it is around 10 weeks of pregnancy. The presence of hCG hormone helps to support the corpus luteum structure for it to produce other important hormones. (Betz & Fane, 2022)

Progesterone is known to be produced by corpus luteum which is a temporary structure in female ovaries, but later in pregnancy placenta is continuing its production. The main function of the hormone is to maintain the uterus all throughout the pregnancy. Low progesterone levels may lead to miscarriages and ectopic pregnancies, so it is important to maintain the levels of the hormone. It is important to prevent lactation up until the birth, and progesterone is

inhibiting lactation until delivery. Another effect is to decrease the ability of myometrial contraction. This process prevents womb muscles to contract until the birth. Progesterone activity also causes capillary growth thus promoting blood and nutrient flow to fertilized egg and foetus. (Cable & Grider, 2022)

Oestrogen is produced by corpus luteum and after a while placenta gets involved and continues the process. Progesterone and oestrogen work together in order to provide normal pregnancy. (Magon & Kumar, 2012) This hormone plays a role in developing foetus organs and systems. During the later phase of pregnancy, oestrogen helps to prepare the body for breastfeeding. It also influences the nail and hair growth due to higher blood circulation. (NCT, 2018)

Relaxin creates a preconception of its functions without researching thoroughly, which makes it understandable how it might react when being pregnant. This hormone is as important as any other mentioned before and it starts its activity from early pregnancy. The main actions are to relax and dilate the blood vessels to be able to increase blood flow with all the necessary nutrients and oxygen to foetus. (Doan et al., 2022) Evidence shows that relaxin is greatly affecting the pelvic stability and joint laxity in pregnant women. It is an essential part of labour when women need looser structures in order to push the foetus out vaginally. Although, more relaxed and flexible ligaments can cause instability of the pelvis and essentially develop in low back or pelvic pain. (Parker et al., 2022)

The main functions for prolactin are to produce milk for breastfeeding and develop mammary glands in breast tissue. Progesterone level drops post-delivery allowing prolactin to activate. Prolactin is producing already during the pregnancy but stays active postpartum if breastfeeding is done. The receptors withing the nipple react to sucking and respond with production of milk, so in best situation for as long as the nipple is being triggered, the milk will produce. If the mother is not actively breastfeeding, the levels of prolactin will decrease to pre-pregnant state in 1-2 weeks' time. (Al-Chalabi et al., 2022)

Oxytocin similarly as prolactin influences the lactation postpartum, although it also has great impact on women during labour. It plays an important role in parturition allowing the uterine/cervix to dilate. It can activate more around 2 weeks before the delivery, but it reaches the highest peak when the baby's head is delivered. Studies show that first time mothers experience higher levels of oxytocin. Oxytocin is considered to be important for building connection between mother and the baby. (Prevost et al., 2014a)

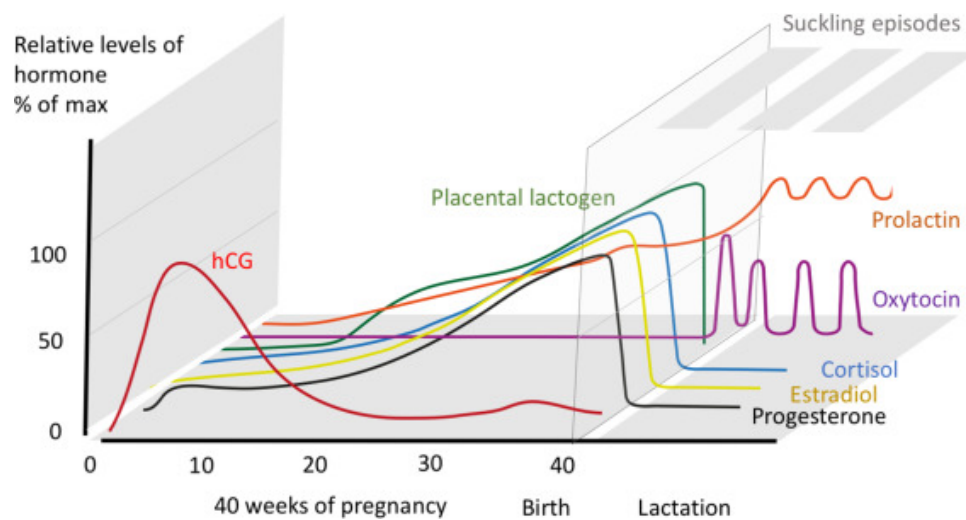


Figure 3: Hormonal changes in pregnancy and postpartum (David R. et al, 2020)

## 4 ANATOMICAL AND PHYSIOLOGICAL CHANGES POSTPARTUM

Postpartum is a period after delivery when all the body systems physiologically and anatomically are beginning to return back to pre-pregnancy state. This process starts when placenta is expelled which is straight after the delivery of the baby. The postpartum period is divided in different phases – acute, sub-acute and late phase. Acute phase is considered to last the first 24h post-delivery. Subacute or middle phase lasts 7 days after that, and late phase lasts from 6 weeks to 6 months. (Chauhan & Tadi, 2023)

To assess the woman postpartum is extremely important due to various risks than can arise from undiscovered postpartum infections, undermanaged health issues, chronic diseases, recovery physically as well as mentally, and of course, the foetal development and breastfeeding. Postpartum care is necessary in order to provide knowledge and recognize issues that might have arisen during the first weeks of postpartum period. Regular check-ups are suggested to observe the first year of postpartum due to risk of maternal mortality. (Stuebe et al., 2018)

Reproductive system is greatly stretched, and organs have changed their natural alignment and size due to foetal growth and delivery. Understandably, there are multiple changes that has happened, and body needs time to realign, recover with the help of the women. First actions come from the uterus and placental site, where rapid muscle contractions occur to prevent blood loss. Such activities might cause abdominal or pelvic pain. In the first six weeks, the weight of uterus decreases approximately 20 times. If at the delivery date uterus weighs about 1000g, by week six postpartum, it can be 50 to 60g, which is considered the normal adult weight. In addition to reproductive system recovery, there is vaginal discharge called lochia that can be present for the first five weeks postpartum. At the start it is red, then pale red and at the end it is white. Lochia consists of blood, endometrial tissues, mucus. (Chauhan & Tadi, 2023)

#### 4.1 Musculoskeletal system

There are various aspects that should be discussed when thinking about musculoskeletal system changes postpartum. In this chapter author will cover abdominal wall and diastasis recti, pelvic floor anatomy and dysfunctions, lower and upper back issue as these are the most common issues that arise during pregnancy and in postpartum period.

Abdominal wall undergoes great stress throughout the pregnancy, especially in third trimester when foetus is growing bigger, and the uterus is expanding significantly. Due to change of centre of gravity and elongated abdominal wall muscles, agonist muscles such as erector spinae, iliocostalis, quadratus lumborum and other are tight and might cause low back pain and even intervertebral joint compression. (Gruszczyńska & Truszczyńska-Baszak, 2019) Abdominal muscles including rectus abdominis, internal oblique, external oblique and transversus abdominis are stabilizing the spine. Studies show that in a case of dysfunction in these muscles postpartum, also back flexors and extensors have decreased muscle strength and endurance, as well as hip abductors and hip extensors are low in strength. Facts provide proof of the importance of abdominal wall strengthening. (Fukano et al., 2021)

Diastasis Recti is a common result in most women during the third trimester and postpartum. It is a stretching and thinning of Linea alba that is fibrous tissue running vertically down the midline of abdomen. It can be measured with finger width, callipers or ultrasound, and the width bigger than 2.2 - 2.3cm is considered to be clinically important. (van de Water & Benjamin, 2016)

Study informs that being physically active and emphasizing core exercises reduces the risk of developing Diastasis Recti as well as increasing pelvic stability. It also discusses the importance of core exercises postpartum to decrease the size of Diastasis Recti. Some researchers provide information on correlation between Diastasis Recti and urinary, faecal incontinence as well as pelvic organ prolapse. (Thabet & Alshehri, 2019a)

Pelvic floor has complex layers of muscles surrounding and supporting internal and external reproductive organs. Urinary bladder and urethra can be affected and result in retention of urine due to higher musculature tone in abdomen, pelvic floor, compression of urethra by oedema. As mentioned before, uterus decreases significantly day by day in postpartum period. (Chauhan & Tadi, 2023)

Pelvic floor muscles divide in fast twitch (30%) and slow twitch (70%) fibres. Both types play a great role in controlling urine and faeces as well as facilitation of sphincter muscle, support in pelvic organ prolapse. During childbirth their function can be compromised and even damaged contributing to needed postpartum recovery. Pelvic muscle prolapse is common amongst women which give birth vaginally and it is the most commonly mentioned contributing factor to pelvic floor prolapse. Anal incontinence is caused by anal sphincter laceration during delivery especially first vaginal birth. (Fonti et al., 2009)

#### 4.2 Endocrine system

Hormonal shifts and changes during labour and right after delivery are high and affect the mother physically and mentally. It is known that progesterone is the most plentiful during pregnancy and its drop right after birth is significant and outstanding. Such dramatic drop in progesterone levels can lead to postpartum depression, but luckily the ovaries will start to produce it on the first menstrual cycle. Rapid drop of progesterone allows lactation hormones to start producing. Similarly, the oestradiol also lowers its levels to promote lactation. On the contrary to progesterone drop effect on the mother, oestradiol is proven to prevent serotonin reuptake which results in natural defence for postpartum depression. (Trifu et al., 2019)

Beta endorphins which are known to relieve pain, are at its peak during labour and decline after birth. Logically, high beta endorphin levels help during delivery and create the feeling of alertness, attentive focus on the process as well

as a euphoric state post-delivery. Together with oxytocin it creates bonding feeling with the mother using skin to skin contact. (Trifu et al., 2019)

Oxytocin levels during pregnancy rise, especially during the third trimester. Some studies show that oxytocin level may differ from woman to woman depending on the which pregnancy it is. For the first time mother's oxytocin levels can be higher than for repeated pregnancy women. (Prevost et al., 2014b)

Disbalances in hormonal levels during and after pregnancy affect the mental and physical health for the woman and even foetal development. Such situation can lead to psychiatric disturbances, depression, insomnia. Results of hormonal imbalance cause postpartum disorders, luckily some of them can resolve on couple months after delivery. (Trifu et al., 2019)

## 5 INFLUENCE OF PHYSICAL ACTIVITY ON BODY

### 5.1 World Health Organization recommendations of PA

World Health Organization (WHO) latest physical activity (PA) guidelines that was published on year 2020 recommends same amount of physical activity than for other adults.

“In pregnant and postpartum women, physical activity during pregnancy and postpartum confers benefits on the following maternal and fetal health benefits: decreased risk of pre-eclampsia, gestational hypertension, gestational diabetes, excessive gestational weight gain, delivery complications and postpartum depression, and fewer newborn complications, no adverse effects on birthweight; and no increase in risk of still-birth.” (World Health Organization, 2020)

As mentioned above, there are several contributing benefits of exercise for pregnant or postpartum women. Respectively, being physically active before pregnancy occurred, is indicated as a positive effect on pregnancy, if exercising is not stopped. Aerobic and strength training are two main components for achieving better health results although light stretching can also be added.



Recommendations suggest practicing 150 minutes of moderate intensity aerobic training weekly which can be 30-60 minutes per day, repeating three times per week. Exercises that are mentioned beneficial in WHO recommendations are brisk walking, wheeling, biking, swimming. In addition to aerobic exercise, there should be incorporated muscle strengthening exercises repeated 2 times per week. For PA to be safe, there are contraindications that must be taken seriously and discussed with the woman and health care specialist. Such contraindications include exercising in heat, exercises with physical contact, sudden increase in intensity after sedentary lifestyle, competition-based PA, importance of hydration, appropriate and safe positions while exercising, pelvic floor activation. In Figure 4 the newest guidelines from WHO is presented what amounts of physical activity and limitations on sedentary behaviour is recommended to improve health and well-being postpartum.

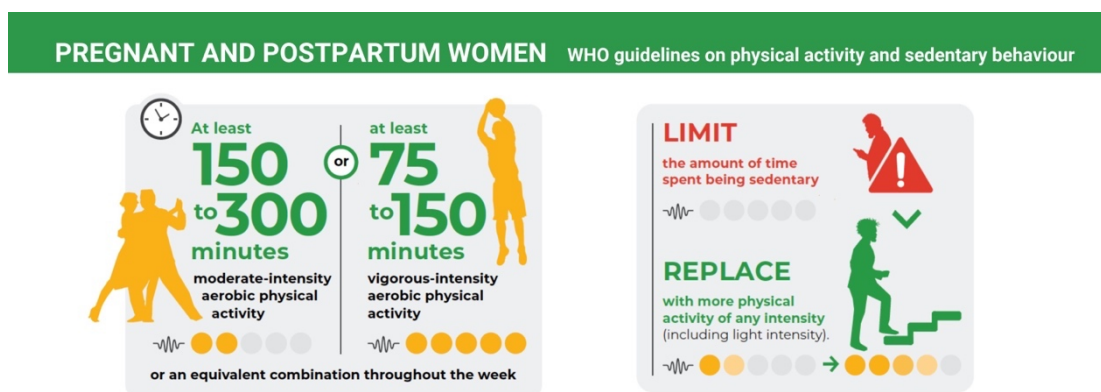


Figure 4: WHO guidelines on PA and sedentary behaviour (WHO, 2020)

While discussion of negative effects of exercise on pregnant women still navigated throughout the society, WHO has confirmed that:

“There have been long-standing concerns about potential adverse effects of maternal physical activity on the developing foetus and delivery. However, recent evidence demonstrates that physical activity is not associated with increased risk of the incidence of miscarriage, stillbirth or delivery complications.” (World Health Organization, 2020)

## 5.2 Benefits of exercise postpartum

The postpartum period is divided in different phases according to time after giving birth. Initial phase, which is still at the hospital lasts couple days, then

follows immediate postpartum which lasts from time of discharge from the hospital to six weeks post-delivery. The later postpartum lasts from 6 weeks to 1 year post delivery. Length of the phases differ in different countries, guidelines. Even though the topic has been discussed more and more, there are still prejudices about engaging in physical activity postpartum. It can be due to lack of knowledge and information given to patients, explaining all the benefits on physical and mental aspects of the body. (Evenson et al., 2014)

Several aspects and concerns are faced when entering postpartum period. Starting a new chapter can cause psychological as well as physical changes. Experiencing disturbances such as urinary, faecal incontinence, fatigue, body composition, diastasis recti, lactation, decreased cardiovascular fitness and psychological well-being is common but also can be solved with persistent work with own body and mind. (Loewen et al., 2020)

Even though the research done on reducing diastasis recti is still limited or hasn't brought up clear results on what methods are more useful and effective than others, it is clear that therapeutic exercises are beneficial. The program must be designed carefully with focus on each patient's disturbances, weaknesses, limitations. (Weingerl et al., 2022)

Fatigue is a common symptom during pregnancy and postpartum that can negatively affect women's ability to take care of herself, daily tasks and the baby. Even though the cycle of being tired because of lack of sleep and not having enough of power to exercise, is comprehensible and existent, there are studies that proved the PA effects on reduction of fatigue. Higher evidence and reliability of the effect is considered from at least 8-week exercise program (N. Liu et al., 2020a).

Many women experience urinary incontinence that is mainly caused by vaginal delivery affecting the pelvic floor muscles. To regain strength, endurance and reaction of these muscles, it is needed to exercise them. Most common way is Kegel exercises in fast and slow contractions aiming at different muscle fibres. Such exercises can start right after delivery of the baby. (Loewen et al., 2020)

Exercises provide information on coordination of the muscles, endurance and ability to contract in fast and slow way. Patients that are assessed are usually examined internally with one finger and asked to perform contractions of muscles in slow and fast way as well as isometric holding of the contraction. To imagine the contraction, patients are explained that they would need to stop the urination. It is common mistake to contract adductors abdomen and gluteal muscles instead of pelvic floor muscles. Therapist must teach to contract only pelvic floor muscles. (Huang & Chang, 2023)

Similarly, as in general population, body composition is a topical concern. Weight gain after pregnancy is common especially if pre-pregnancy obesity is present. Such situations lead to higher risk of bigger foetal size and weight, longer labour, emergency caesarean section and other. Aerobic and resistance training help to control the weight gain during pregnancy and reduce it postpartum as well as decrease the risk of cardiovascular diseases. (Loewen et al., 2020)

Lactation is a natural process providing food for the baby, nevertheless, it decreases bone mineral density (BMD). The rapid decrease is proven to improve when exercising with resistance and placing axial load on the spine. It is understood that resistance training is helpful for women postpartum that are breastfeeding. (Loewen et al., 2020)

### 5.3 Pelvic floor and abdomen rehabilitation

As mentioned before, vaginal birth, especially for the first time, has a great impact on the health of pelvic floor muscles. Unfortunately, the prevalence of pelvic organ prolapses (POP), levator ani muscle avulsion, urinary and anal incontinence (UI, AI) is common and pelvic floor dysfunctions (PFD) are affecting numerous women who has given birth vaginally. After such occurrences body needs time to recovery or even undergo a surgery however there are

conservative techniques that have evidence of improving pelvic floor function. (Urbankova et al., 2019)

Pelvic floor muscle training (PFMT) is a common conservative treatment for PFD. In general, consequences of untreated pelvic floor leave a negative effect on overall health, mental status, cause dyspareunia and other factors. Respectively, if there is a tool that can be done and tried without medical intervention, it is worth the try. In many European countries, PFMT is suggested post-delivery and on repeated observations and consultations. Women with mixed symptoms of POP, UI, AI is common and even then PMT is suggested together with transcutaneous electrical nerve stimulation (TENS), electrical stimulation with biofeedback, as a result improving sexual functions and reducing symptoms of UI and AI and other POP symptoms. (Romeikienė & Bartkevičienė, 2021a)

Abdomen containing different structures, organs and muscles encounter changes in alignment, length, strength, mechanics, stability, posture and function during pregnancy and postpartum. Low back pain prevalence is high amongst pregnant and postpartum women. Pelvic floor weakness is also linked with Diastasis Recti Abdominis (DRA) which is the main reason why taking care of core and back is necessary. Even though DRA can spontaneously resolve itself over time, trunk stabilization exercises effect on other symptoms within the body and improve the quality of life and functioning.

“The transversus abdominis, pelvic floor, deep multifidus and diaphragm or the deep core stabilizing muscles form a muscular cylinder, which supports the spine and the pelvis; these muscles work together as a unit to ensure and maintain trunk stability.” (Thabet & Alshehri, 2019b)

#### 5.4 Cardiovascular system

Pregnancy affects the cardiovascular system not only in changing the alignment of structures, but also the volume of blood circulated around the body, heart rate, blood pressure, cardiac output and other factors. Understandably,

it is needed for such changes to occur due to foetal growth, development and ability to provide healthy environment for the foetus. (Chauhan & Tadi, 2023)

Well established recommendation suggests aerobic physical activities that can start soon after delivery. Such activities like walking, strolling is necessary to improve cardiovascular fitness, improve oxygen consumption and circulation around the body (Schuiling et al., 2017, p. 821) as well as manage weight and fulfil WHO recommendations on aerobic physical activities in postpartum period (World Health Organization, 2022). Aerobic physical activities are needed but nevertheless, too vigorous activities are not suggested due to possibilities of excess bleeding (Jordan et al., 2018).

Numerous studies over the years have shown the link between hypertensive disorders of pregnancy and future cardiovascular diseases. In a way, pregnancy can be a “stress test” that would indicate women at risk for cardiovascular diseases. Studies have demonstrated that reduced cardiovascular capacity during pregnancy are raising the risks of developing hypertensive disorders of pregnancy even after delivery. (Al-Huda et al., 2022)

## 6 INFLUENCE OF PHYSICAL ACTIVITY ON MIND

### 6.1 Physical activity and hormones

Physical activity is closely related to endocrine system with hormonal changes that effect the human body. There are several hormones that react in different ways, contributing to various aspects like sleep, mood, muscle growth, heart rate, metabolism and many other factors. Knowing that physical activity can greatly influence mind and body, there is enough of proof that postpartum women should perform some type of physical activity for the sake of healing as well as return to prepartum state and even improve it. (Lucinda hampton & Kim Jackson)

There are many hormones that contribute to benefits of health, but author describes the following: human growth hormone (HGH), adrenalin, dopamine, serotonin and beta-endorphins. HGH is produced during sleep, but with strength and cardiorespiratory exercise can increase the quality of sleep thus promoting its production. Adrenalin is known of its functions in increasing the heart rate, blood pressure in result promoting better oxygen and energy flow. With regular exercise, adrenalin level decrease at rest and subsequently stress feeling is reduced. Exercising promotes dopamine creation and it has benefits of reduction of depression and stress. Serotonin is known as a hormone that increases happiness, mood, memory, sexual function, social behaviour, and affects also on sleep. (Lucinda hampton & Kim Jackson) Lastly, beta-endorphins are widely known for its effect on reducing stress and pain, as well as increasing the feeling of euphoria and excitement. Exercise has been shown to increase beta-endorphin levels. (Pillozzi et al., 2020)

### 6.2 Benefits of exercise on mind postpartum

Acknowledging the benefits mentioned above it is understandable how depressive and stress symptoms can be reduced or even suppressed. Postpartum depression affects up to 25% of new mother in the first year after birth. There are

different ways of treating depression, one of the most known is antidepressants. Recent studies confirm that physical activities are as much effective on treating depressive symptoms as medication. Another method that is suggested is Cognitive Behavioural therapy (CBT). There are alternative methods besides medication that can be just as effective which means that postpartum depression has multiple treatment options. (Nakamura et al., 2019)

Fatigue is a common symptom amongst pregnant and postpartum women that greatly affect the daily life and limits the intensity of different activities. Study presents that contributing to supervised 8-week or longer exercise program postpartum, significantly reduces fatigue symptoms. Researchers believe that pregnant women lack knowledge of the benefits of PA on herself and the foetus that it limits the activity levels. Fear of negatively influencing the baby is a big factor of not involving into any physical activities. (N. Liu et al., 2020b)

Postpartum depression and anxiety are widely common amongst postpartum women due to lack of support, emotional and physical changes and it negatively affects the baby's health as well. Over the years scientists and researchers have concluded that aerobic physical activity reduces the depression and anxiety symptoms and lately they have confirmed that postpartum women are likely to reduce the symptoms if participating in regular aerobic physical activities. Although, the proof that regular physical activity done throughout the pregnancy can reduce postpartum depression symptoms is still under research. Aside from pharmacological intervention, psychotherapy, there is a method that can be tried to improve the health in general postpartum. (Davenport et al., 2018)

## 7 POSTPARTUM PHYSIOTHERAPY

### 7.1 Use of psychosomatic physiotherapy approaches in postpartum period

There are numerous psychosomatic physiotherapy methods that can be used to improve mental health of a new mother although the research and proof on such topic is still limited. Nevertheless, some methods are widely known to promote relaxation, circulation improvement and are tried on postpartum women to be effective. Yet, what method might be beneficial and effective for one, does not necessarily mean that it will be as effective for another person so individual approach for each woman is highly recommended. Emphasize on mind and body connection is limitless, therefore, they cannot be separated.

#### 7.1.1 Cognitive behavioural therapy

Cognitive behavioural therapy (CBT) is widely recognized therapy approach to treat depressive and anxiety symptoms as well as improve the bonding between the new mother and infant for postpartum women. There are multiple reasons why the new mother could feel depressed, anxious and not well bonded with her child. Per example, lack of family and/or community support, sleep deprived, low mood, coming to terms in changes in her body image, not enough of information, help from health system/professionals, coping with physical labour trauma, need of greater emphasis on mothers' wellbeing. CBT has been proven to improve depressive and anxiety symptoms in postpartum period although the accessibility to such service is limited in many countries due to high demand or lack of therapists that are specifically educated on it and provide it. (Finlayson et al., 2020)

#### 7.1.2 Breathing exercises

As discussed before, there are several changes in multiple body systems that undergo alterations in their functions, size, capacity and effort. Pulmonary or respiratory system are affected greatly by pregnancy due to enlargement of



the uterus and breasts. Changes in organ alignment, ribs, diaphragm are seen ultimately affecting lung functions and their capacity. A study presents how different breathing exercises can improve the lung functions significantly by practicing diaphragmatic breathing, segmental breathing, lateral costal expansion, posterior basal expansion, pursed lip breathing and thoracic mobility exercises for 8 weeks. In addition to breathing exercises, well known pelvic floor exercises, postural correction exercises, back and baby care techniques must be accompanied together for best possible results. (Tomar & Rathi, 2014)

### 7.1.3 Progressive muscle relaxation technique

Progressive muscle relaxation technique (PMR) is commonly used not only in postpartum period but also to reduce stress, pain, anxiety, depression in everyday life. Technique involves tension-release cycle combined with breath work to achieve deeper relaxation level contracting and releasing big muscle groups of the human body. Another benefit of PMR is to improve body awareness in postpartum period which can positively affect on improving general comfort. In addition, non-invasive, non-pharmacological methods of relaxation and improvement of health is an advantage. Study showed positive results of implementation of PMR to reduce postpartum depression. (Gökşin & Ayaz-Alkaya, 2020)

### 7.2 Physical activity methods in postpartum period

According to World Health Organization (WHO), the newest guidelines suggest implementing various types of physical activities on daily basis. As mentioned before, in postpartum period woman should include aerobic activities of 150 min per week, which would be around 20-25 min per day of activities like walking, swimming. Also, incorporating strength, resistance and light stretching is beneficial for full recovery. Furthermore, reduction of time spent sedentary while awake, is recommended. Although, WHO suggest consulting with

health provider about physical activity appropriateness, intensity, education on when to stop if something inadequate is felt. (World Health Organization, 2022) In recent years it has been studied how women's' negative state of mind in the first year postpartum can influence their daily life, increase vulnerability, decrease relationship quality and overall quality of life due to eating disorders. Such situations decrease the motivation and willingness to presence of physical activity in everyday life. Although, it has also been proven that regular physical activities during postpartum period improve and enhances general health, sleep quality, recovery itself and even partner relationships. This cycle of negativity and subsequence that arise from it, greatly affect women's health and recovery process although it is known that physical activity can help to improve not only physically but also mentally. Engaging to exercise and relationships with physical activity in general is the key to motivation for health body and mind. Of course, situation at home, family support, financial aspects play a huge role. (Liva et al., 2021)

Exercising postpartum should be evaluated individually by a health professional according to type of delivery, length of it and medical or surgical complications. To tell an exact time when one can return to exercise depends on each woman individually, although, Kegel exercises, light aerobic exercises like walking, usually can be performed soon after delivery. ("Physical Activity and Exercise during Pregnancy and the Postpartum Period: ACOG Committee Opinion, Number 804," 2020)

### 7.2.1 Pelvic floor exercises

The prevalence of pelvic organ prolapses or dysfunction is higher after vaginal delivery explaining why pelvic floor muscle training is an important part of postpartum recovery process. Few of the dysfunctions that are most likely to be improved by pelvic floor muscle training are urinary incontinence and sexual life quality. Multiple studies present that when obstetrical injuries like levator ani tears or anal sphincter injuries of third-degree tears are present, pelvic floor

muscle training does not show significant improvement. (Romeikienė & Bartkevičienė, 2021b)

Recent study about Kegel exercises in combination with electrical stimulation was done to compare 3 experimental groups. One received a program of Kegel exercises, another electrical stimulation and third received the combination of both. Results presented significant increase in pelvic floor muscle strength and vaginal pressure in a group that received the combination of exercise program and electrical stimulation. Such approach can have good therapeutic outcomes for women in the first year postpartum. (Chen et al., 2023)

### 7.2.2 Deep core stabilization and strengthening

Deep core stabilizing muscles are diaphragm, pelvic floor, transversus abdominis and multifidi. Exercise program that involves promoting stability of deep core are found to be effective in reducing diastasis recti, respectively also contributing to reduction of low back pain and low back pelvic pain. Gradual increase of intensity and correct technical performance is the key. Study shows that deep core stability program combined with traditional abdominal exercise program have better results on affecting trunk stability, muscle strength and stability reducing diastasis recti. (Thabet & Alshehri, 2019c)

### 7.2.3 Aerobic activities























Previously discussed WHO guidelines present various moderate intensity aerobic physical activities that are suitable for women in postpartum period. Such activities are light jogging, swimming, walking, stationary biking, low impact aerobics, modified yoga and Pilates. Moderate intensity is about 64-74% of max HR, which can be interpreted by being able to talk but not sing anymore. (World Health Organization, 2022)

Reduction of sleep quality in new mothers is widely popular and is associated with postpartum depression and fatigue. To regain and maintain good sleep

quality is challenging yet extremely important for mental health, immune system, metabolism, cognitive functions and mood. Study presents that walking everyday has proven to reduce physical symptoms of sleep inefficiency in short period of time regardless of the night-time awakenings. Unfortunately, in 12-week period of time, the difference of sleep quality showed no significant difference. (Y. H. Liu et al., 2021)

Return to running postpartum is a topic commonly discussed about and in recent years there are guidelines that present information on what physical form a women must be in, to be able to run safely. An important aspect for a woman to keep in mind is to focus on physical state and not the weeks after labour. Even if the guideline presents that at the earliest of 12 weeks postpartum a woman can try to return to running, it still requires a specific test that should be done to ensure safety of running. In addition, each case must be evaluated individually. If a woman hasn't been able to do any preparation beforehand with pelvic floor, abdominal, back and leg strengthening, there might be consequences that arise after a run. Therefore, previous running or exercise intensity experience in general is important to take into account when discussing return to running with a patient. (Donnelly et al., 2020)

Load and impact management assessment includes activities to be performed without incontinence, dragging, pain or heaviness. Such activities are: walking 30 minutes, single leg balance 10 seconds, single leg squat 10 repetitions per side, jog on spot 1 minute, forward bounds 10 repetitions, hop in place 10 repetitions per side, single leg running man 10 repetitions per side. To ensure strength for main muscle groups that are under stress when running, test includes single leg calf raise, single leg bridge, single leg sit to stand, side lying abduction. Repetitions are aimed to 20. Nevertheless, if weakness is noticed it shouldn't be a barrier to return to running but identified where strength work can be implemented. (Donnelly et al., 2020) Figure 5 presents guidelines for health professionals to manage situations of return to running postpartum.

EXAMPLES OF EXERCISE PROGRESSION IN THE POSTNATAL RUNNER	
Weeks Postnatal	Examples of Exercise Progression
Weeks 0-2	 Pelvic floor muscle strength & endurance  Basic core exercises e.g. pelvic tilt  Walking for Cardiovascular exercise
Weeks 2-4	 Progress walking, pelvic floor muscle/core rehab    Introduce squats, lunges & bridging in line with day-to-day requirements
Weeks 4-6	 Low impact exercise - static cycling  Low impact - cross trainer Individualise according to postnatal recovery, mode of delivery, perineal trauma & saddle comfort
Weeks 6-8	 Scar mobilisation  Power walking  Increase low impact exercise  Add dead lift  Add resistance to lower limb & core
Weeks 8-12	 Introduce swimming  Dependent if lochia stopped & wound healing satisfactory  Spinning if comfortable sitting on a spinning saddle
Week 12 & Beyond	 Graded return to running  Goal specific  Consider running coach  Consider risk factors e.g. obesity  Modify according to signs & symptoms

Source - Goom T, Donnelly G & Brockwell E. Returning to running postnatal - Guidelines for medical, health and fitness professionals managing this population. March 2019




Figure 5: Return to running postpartum (Donnelly et al., 2019)

## 8 THESIS PROCESS AND METHODS

The thesis was ordered by Satakunta University of Applied Sciences Degree Program in Physiotherapy. It is practice-based research and the reason of choosing such method was based on authors preference and the aim and objective of the study.

Thesis process began with choosing the topic. Author was inspired by the field of pregnancy and postpartum during one of the clinical placements in early 2022. There the author met clients being pregnant and postpartum and observed how physiotherapists of the clinic deal with different situations. After some time, student was given a chance to provide a session for a woman 8 weeks postpartum with diastasis recti. After some time of preparation and research on the topic before the physiotherapy session, student realized that until then such topics were not covered at the university, so the idea of creating

material for students and educating them in this developing physiotherapy field, is absolutely mandatory.

During that year, student collected thoughts about writing the thesis on such subject in addition to attending extra courses in her home country Latvia about postpartum period. During the fall, the topic narrowed down and became clearer, so thesis plan was presented in December 2022. During 2023, author wrote the theory and other chapters alongside with long practical placements abroad that happened from March 2023 until July 2023. In August and September, author finalized the thesis. The final presentation occurred in October 2023.

Methods of the thesis were to gather the information from evidence-based articles, researches, publications, guidelines and books. Then based on the evidence, write the thesis and finally create a self-study material on Moodle H5P platform for physiotherapy students of SAMK. Databases used to conduct the study were PubMed, Google Scholar, Science Direct and official health organizational websites to reach guidelines on the topic. Inclusion criteria were women that have given birth vaginally and through c-section, women who have had multiple children birth. Exclusion criteria were men, transsexual cases, women who have been pregnant but haven't given birth.

Research was done in English.

## 9 IMPLEMENTATION OF THE INDEPENDENT STUDY MATERIAL

The creation of independent study material for physiotherapy students was based on the active research thesis method which the author chose at the start of the thesis process in early 2022. Such independent study material allows students to acquire knowledge on topics that are not widely discussed during the lectures, in addition, the material is provided on an interactive program called H5P on study platform Moodle. The program allows to use text, videos, pictures, charts and other visual material to provide better understanding of the topic in an interactive and comprehensive way. Moreover, after each section, quiz of couple true/false or multiple-choice questions were asked. That allows students to see if the information read has been understood.

For piloting author recruited international physiotherapy students from second and fourth year that showed interest in participating in the piloting and topic itself. Second year students were chosen because the knowledge of the topic can be useful in their upcoming studies and clinical practices as it combines physiotherapy approaches that hasn't been taught yet, per example, psychosomatic physiotherapy. Fourth year students were chosen because they might have encountered clients in postpartum period and the material gives an opportunity to see and evaluate if the physiotherapy methods and modalities they used are relevant and learn new information, aspects to keep in mind when approaching similar situations in the future.

A total of 12 students showed interest in participating in the piloting the material, which was open for students from 19.09. until 26.09. After the deadline, 10 answers were collected, which means that the drop out number was 2. Feedback was collected using Google Forms through multiple statements that were marked from 1 (completely disagree) to 5 (completely agree) (Appendix 1). At the end, students were asked to answer to questions in free form, describing their thoughts, opinions, suggestions on the material (Appendix 2).

Based on the given feedback, author made changes, improvements to the independent study material. Overall, the feedback was positive, and students confirmed that they learnt new and useful information. Nevertheless, students suggest adding more information on Kegel exercises, their description as well as more detailed information about specific deep core stabilization exercises. Moreover, author improved section about diastasis recti as it had risen questions in the google form questionnaire. Even though the students asked for clear tips and suggestions on recovery from c-sections, author decided not to write anything specific as the recovery itself is very individual in such cases and requires full medical check-up before starting anything.

Even though at this moment, it is not decided where will the independent study material be used, it sure that in the new physiotherapy studies curriculum there will be need of such study platform. Most probably, such material will be useful in Health Promotion course during 2<sup>nd</sup> or 3<sup>rd</sup> year studies. Teachers that will provide the course, will be introduced to the material and encouraged to implement it in the course when discussing about pregnancy or postpartum periods.

## 10 DISCUSSION

Thesis process started with a clear vision towards the field of physiotherapy author is interested in. At the start, topic was discussed with thesis supervisor teacher and with her help, thesis idea was narrowed down and reached the final name and direction. Writing process started in early 2023, and throughout the spring, summer and September, it was done. Even though the original plan was to finish the writing earlier, but due to long clinical practices during the spring and summer, it took more time. As the author prefers actual hands-on process, the idea of action research was decided early on.



The purpose of creating and independent study material for physiotherapy students on an H5P platform, is to provide useful theoretical and practical information to students that has or will encounter postpartum patients in their clinical practices or career later on. Even though, this field of physiotherapy is becoming more and more popular, it is also still developing, and the information varies from research to research and professional to professional. That is why, an insight of the topic is beneficial in order to understand the overall situation in postpartum physiotherapy. Must add that further specialization is needed to gain more knowledge and skills for postpartum physiotherapy that can include also pelvic floor examination internally.

Researches done on the topic are in great quantities all over the world, which approves the fields growing and expanding. Nevertheless, results from many studies with same goal can be very different due to individuality of each patient, so further high-quality studies that include broad participation can present the issues, struggles, challenges as well as methods that are found beneficial for the majority. Positively, there are multiple guidelines that are created in couple of countries that are leading in health-related research as well as World Health Organizations' guidelines on postpartum period.

Whilst the postpartum period in many studies and articles are described more from physical aspect, there is a great need to address also the mental recovery and adjustment to new roles in life. Hormonal aspects and changes influence the recovery process in all its components – sleep, fatigue, stress, anxiety, depression, pain and more. Balanced hormonal system can improve everything mentioned above and increase positive feelings, appreciation, happiness. To contribute to that, physical activity and psychosomatic physiotherapy approaches in combination can improve health, overall feeling and balance in in daily life. Such combination approves the body and mind connection and the inability to separate these aspects.

During the writing author faced lack of information particularly in psychosomatic physiotherapy modalities that has A class evidence on improving the postpartum period. Couple of studies were done on the topic, and author

realized it is a field that is also very individual as one approach can be suited for one woman, but not very beneficial for other. That brings up a conclusion that individual approach to each postpartum woman and her symptoms, is a must. Each approach should also be evaluated in a way if a woman can repeat it at home, find time for it and see its benefits. Nevertheless, psychosomatic physiotherapy field is growing and awareness of it is being brought up to society. Which means that the society is becoming more educated on the topic and open for discussion on future development.

This thesis is a small step towards the awareness and knowledge each physiotherapist should know when encountering a woman in postpartum period. Moreover, educational institutions in health sector can benefit from a course that emphasize not only the physical aspects but also the emotional and mental and teach the new professionals on how to approach a patient with per example postpartum depression. Such cases can be accompanied with musculoskeletal pain which encouraged the patient to see the physiotherapist, so for a professional to perform proper assessment, notice, listen and acknowledge the other side of the story, is important. There is a high possibility, that many professionals that lack knowledge or confidence in psychosomatic physiotherapy or know the benefits of correct therapeutic exercises and PA, would suggest a psychotherapist, but there are tools for physiotherapists that can be tried in order to help the patient in conventional way. Yet, interest, knowledge and possibly even extra education can help the physiotherapist to fully understand and help the patient.

Author is interested in the field and wishes to educate further on pelvic floor physiotherapy as well as psychosomatic physiotherapy to provide better services for future clients. Author hopes that thesis and the material provided for the students on H5P platform will be useful when learning about postpartum period and what it can bring.

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## APPENDIX 2:

Can you please share your thoughts about the study material, what did you like/dislike and why? Would you prefer more information in the study material? Do you have any ideas or suggestions that comes to your mind to improve the material? \*