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**How manual lumbar traction affects  
pain levels and whether it has any  
clinical benefits in patients with low  
back pain: a systematized literature  
review**

DEGREE PROGRAMME IN PHYSIOTHERAPY

2020

Author(s) Kitsios Kyriakos	Bachelor's thesis	19.11.2020
	Number of pages 37	Language of publication: English
Title of publication HOW MANUAL LUMBAR TRACTION AFFECTS PAIN LEVELS AND WHETHER IT HAS ANY CLINICAL BENEFITS IN PATIENTS WITH LOW BACK PAIN: A SYSTEMATIZED LITERATURE REVIEW		
Degree programme Physiotherapy		
<p><b>Abstract</b></p> <p>The objective of this thesis was to conduct a systematized review of the most recent evidence with aim at the topic of manual lumbar traction effectiveness in patients with low back pain.</p> <p>The thesis is organized as follows. First, the theory related to spine anatomy is discussed. Next, the pain, its physiology and classification as well as specifics of low back pain is described, and the theory is concluded with description of manual lumbar traction theory. The following paragraphs introduce, the designing process of the literature search (the review was conducted by using PICO framework and PubMed as the search library), evidence based selection process, appraisal of the evidence, and results of this systematized literature review.</p> <p>The results of this review show that manual lumbar traction has positive effects on patients who suffer from low back pain. However, the search found only one study dedicated to the selected topic and there is only subjects feedback assessing the change in pain levels (ODI and NRS). This shows the clear need for further investigation of the topic, to understand the exact changes that occur in human bodies.</p> <p>Although, manual lumbar traction should be used and it is safe, there is lack of information to reveal the hidden changes occurring during and after the intervention.</p>		
<p><u>Key words</u>          Manual Lumbar Traction, Low back pain, Pain level, Effectiveness</p>		

## CONTENTS

1	introduction.....	4
2	ANATOMY OF THE SPINE.....	6
2.1	Introduction to the Spine.....	6
2.2	Bones of the spine.....	6
2.3	Intervertebral Discs.....	9
2.4	Ligaments of the spine.....	10
2.5	Nerves of the lumbar spine.....	11
3	PAIN.....	12
3.1	Definition of pain.....	12
3.2	Physiology of pain.....	12
3.3	Different types and classification of pain.....	13
4	LOW BACK PAIN.....	15
4.1	Understanding the wider concept of low back pain.....	15
4.2	Epidemiology and prevalence of low back pain.....	16
4.3	Chronic musculoskeletal pain.....	17
4.4	Non-specific low back pain.....	17
4.5	The economic effect of Low Back Pain.....	18
4.6	Risk factors.....	18
4.7	Pathophysiology of LBP.....	21
4.8	ICF.....	22
5	MANUAL LUMBAR TRACTION.....	24
5.1	Definition of manual traction.....	24
5.2	Types of manual traction.....	24
5.3	Mechanical effects.....	25
6	AIMS AND OBJECTIVES OF THE THESIS.....	26
7	ANALYSIS OF THE LITERATURE REVIEW PROCESS.....	26
8	METHODOLOGY.....	27
8.1	Construction of the search.....	27
8.2	1st stage of the Study selection.....	28
8.3	2nd stage of the Study Selection.....	28
9	RESULTS.....	30
10	CONCLUSION.....	30

11 DISCUSSION.....	31
REFERENCES.....	33

## 1 INTRODUCTION

Traction therapy is a general term which includes many different techniques of using mechanical force to create space at the lumbar vertebrae along spine's inferosuperior axis. (Ralph et al. 2012) Basically, during the implementation of lumbar traction, most physicians rely heavily on their specialists' opinions when making final decisions about the treatment. Therefore, the research mainly focused on reviewing the present information about the treatment of low back pain. Similarly, the study aims at understanding how lumbar traction affects patients' pain levels who have low back pains. The paper also identifies what, or if available, substantial evidence to support experts' views in making decisions about its treatment. Most specialists come up with different ideas depending on how certain methods affect patients with low back pain. For example, in clinical studies evaluating its effectiveness, the review found that their results were still controversial even though lumbar manual inclusions were well documented. (Kuligowski, Debiek-bak & Skrzek 2019.)

The inability to unmistakably exhibit the clinical advantage of lumbar foothold might be found in the changeability of the classifications of side effects and treatment methodology utilized in the examination. Out of the ten kinds of lumbar traction appeared recorded as a hard copy, the two generally used static and unpredictable mechanical foothold. The indications, obstruction, and treatment alternatives for these two sorts of pulls are analysed. In light of this investigation's discoveries, further assessment is required to decide the appropriate length of treatment, repeat, and how to control lumbar firmness. Besides, frameworks for positive segregation of patients based on focused benefits should be developed and adopted. Nowadays manual lumbar traction is included in some European academic curricula. The goal of this is to decrease the level of the existing pain and improve the nutrition of the spinal structures. The main and most logical research question that arises is what the efficiency of it is. (Shterenhis, 1997.)

Low back pain is becoming more and more famous in the western world with a prevalence example of 80% of Americans being likely to experience LBP at least once in their life. Making LBP the winner of the title of the most expensive type of pain. A

large part of these cases is due to herniated discs and these have the highest rate for reoccurrence. (Chawla 2018, 1.)

## 2 ANATOMY OF THE SPINE

### 2.1 Introduction to the Spine

The anatomy of the spine is a very interesting part of our bodies to study. It consists of complex and strong bony structures, tendons and ligaments that have remarkable flexibility, strong muscle groups, excellent cushion mechanisms such as discs and very sensitive nerve roots and spinal cord. Humans often ignore their function and consistency until they feel some sort of pain or discomfort in the area. (Agur & Dalley 2014, 1.)

The spine's composition is highly respected because it provides the body with a rare combination of functions. These include protection of the spinal cord which is one of the most important components of our nervous system for transferring information from and to it. It has also a great cushion mechanism that decreases the intensity of all the shocks that our body receives. This job is done by the ligaments and the discs between the joints. One more function is the big variety of movements that it can perform such as flexion and extension in all directions. Lastly, it is worth it to underline the strength and stability for an upright posture that the combination of all the structures can provide. Furthermore, it is important to understand the strong bond that all these structures share. Because if one component sustains an injury or an impairment in general all the rest will be affected sooner or later. (Whetstone 2020.)

### 2.2 Bones of the spine

The bony structures of the spine are called vertebrae and they are 24 in total. They look like disks and almost all of them are placed on top of each other creating a bow shaped arch with the most angled part of it in the thoracic spine. By creating a column like structure their most important function is the protection of the spinal cord, as the skull, for example, protects the brain. The connection between them is created by forming joints. The vertebrae differ with each other depending in which place they are. Hence, those that are placed in the neck area are called cervical, in the thorax thoracic, in the low back lumbar, and in the sacrum sacral. (Agur & Dalley 2014, 3.)

The top seven are the cervical vertebrae and the top two of them are responsible for the ability of the head to perform all its movements. Professionals also refer to them with the abbreviation C1-C7. Lower than these seven, in the area behind the chest, are the twelve thoracic vertebrae which are also connected with joints with the ribs (T1-T12). In each one of the thoracic vertebrae two ribs are connected, one on the left and one on the right side of the segment. This connection creates the rib cage which also serves as the “body armour” of the lungs and the heart. This area is also called the upper back. The next five are called lumbar vertebrae (L1-L5). They are the biggest compared to the rest because they are capable of bearing more weight. Lastly, we have the sacrum and the coccyx, which have as a main function the connection of the upper part of our body with the lower limbs. The sacrum forms joints with the hip bones, and the coccyx is connected with the pelvic muscles. Figure 1 shows the spinal column’s shape and the difference between the vertebrae. (Caratozzolo 2020.)

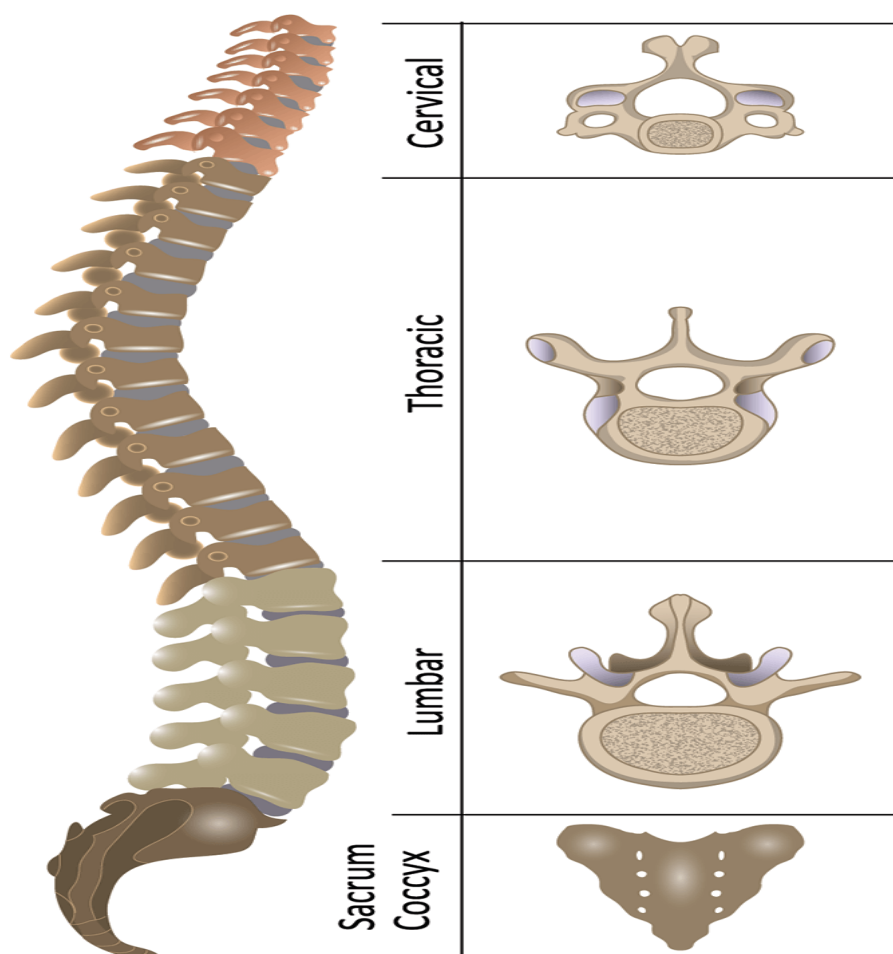


Figure 1. The spinal column. (Website of Scientific Information Page 2020)



Besides the two first cervical vertebrae all the rest have similarities. Each one of them have a drum-like part which is in the front side and it is called the body. Its main responsibility is to provide support in weight bearing. At the back side of the vertebrae we find a bony circle which is called the lamina and the round space that is created is the spinal canal. Through this space the spinal cord and nerve roots pass. Around the arch there are three projections which serve as attachment points for muscles and ligaments. The hindmost projection in every vertebra is named the spinous process and the remaining two which are located on each side of the lamina are called transversus processes. In most people we can palpate and feel the spinous processes through the skin. Figure 2 shows the main parts of a vertebra.(Tortora & Derrickson 2014, 192.)

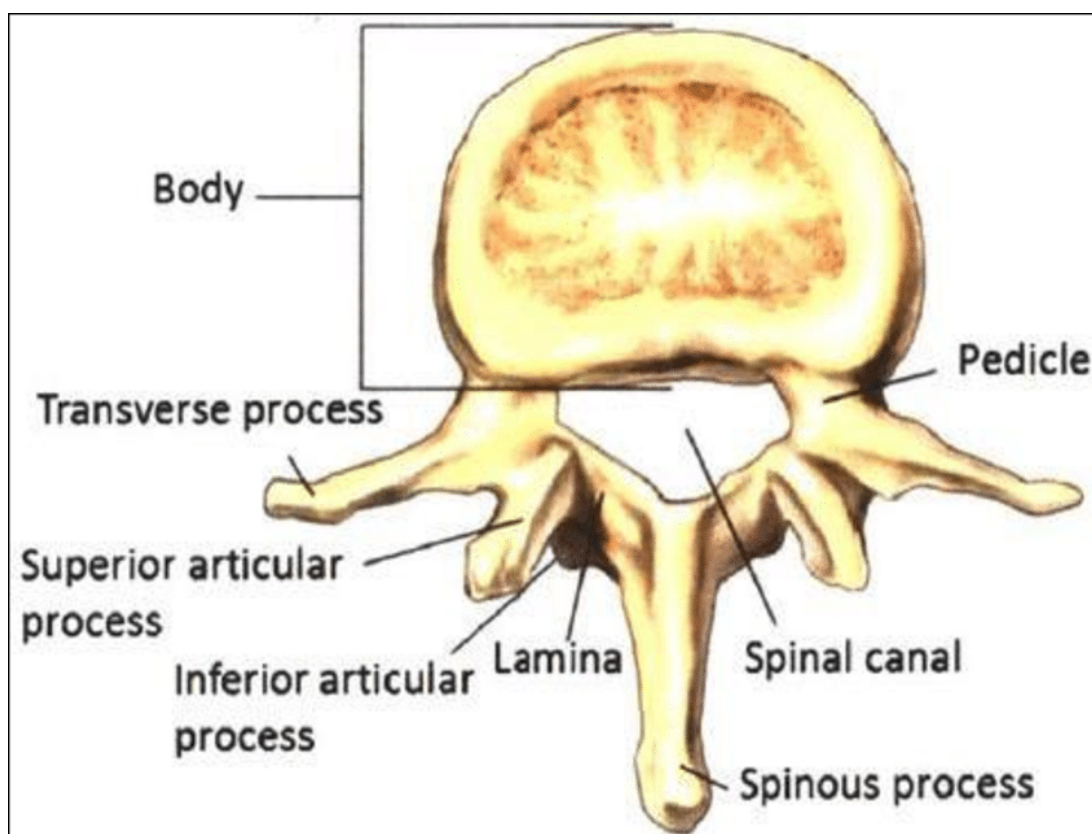


Figure 2. Superior view of lumbar vertebra (Wang 2012)

### 2.3 Intervertebral Discs

The protuberances of the vertebrae (transverse and spinous processes) which provide space and serve as attachment points, for the ligamentous and muscular structures, give the ability to the spine for movement and to have good support. One structure that stands in high importance in the spine are the intervertebral discs, which are composed of an outer fibrocartilage layer called annulus fibrosus and an inner highly elastic layer called nucleus pulposus. The outer part of the annulus fibrosus enters the vertebral bodies and contains all the nociceptors and proprioceptive nerve endings. On the other hand, the inner part of it connects with the nucleus pulposus and provides extra support when compression occurs. It is important to mention and for the reader to understand that up to 70% of the load that occurs during compression of the vertebrae is managed by the nucleus pulposus and its elastic ability. It can expand when vertebrae are compressed with each other and work as a cushion for the bony structures. (Agur & Dalley 2014, 18.)

To be more specific, the nucleus consists of proteoglycan molecules. These molecules have the ability to bind with water 250% greater than their weight. This amount decreases as we age. By the age of the thirties this amount decreases to 90% and by the age of seventy to 65%. In addition, the nutrition of the discs mainly depends on water diffusion, except the outer third of the annulus which receives nutrients through blood supply. Figure 3 assists to visualize the morphology better. (Chawla 2018.)

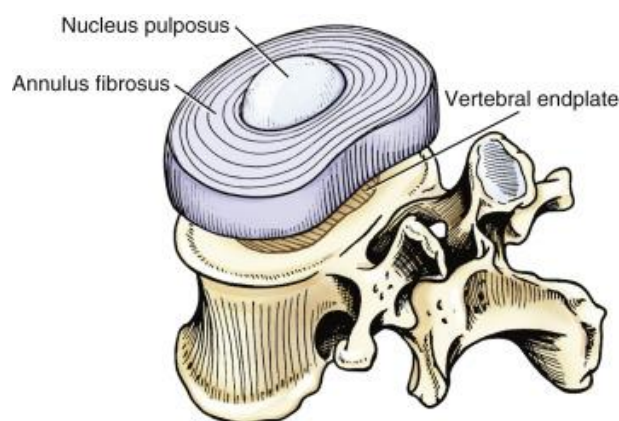


Figure 3. Intervertebral disc. (Mansfield & Neumann 2019, 180)

## 2.4 Ligaments of the spine

Ligaments are the main connective mechanism between cartilage and bones. They consist of sheets or fibrous bands of connective tissue. Their main responsibility is to provide joint stability while moving or resting. They serve also as protectors of excess motion. The most important and those which are mainly linked with LBP are: The Posterior Longitudinal Ligament, the Anterior Longitudinal Ligament and the Ligamentum Flavum. Figure 4 shows where they are placed. (Bridwell 2020.)

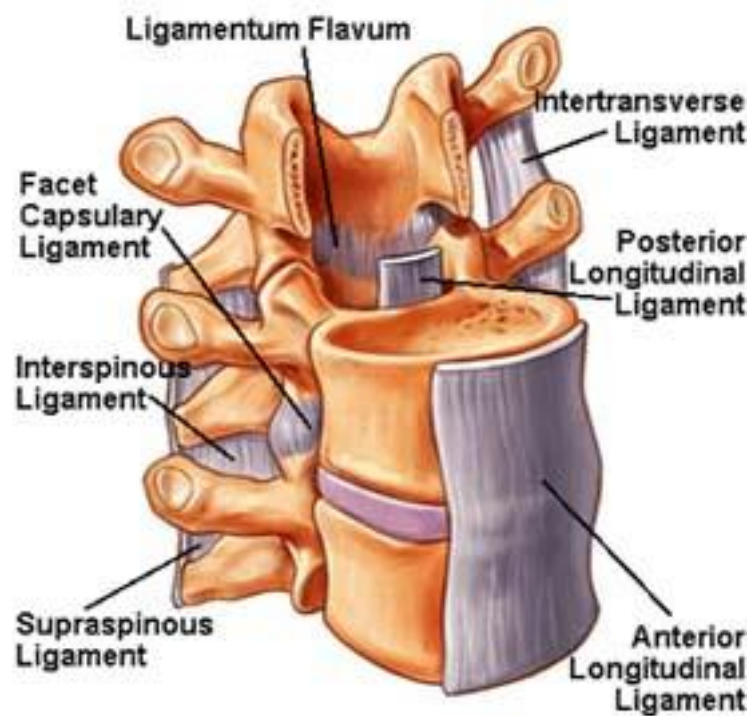


Figure 4. Ligaments of the spine. (Bridwell 2020)

Each one of them serves a more specific purpose. The Ligamentum Flavum runs over the dura matter (tissue that covers the spinal cord) providing extra protection in the spinal cord. It is connected under the facet joints. The Anterior longitudinal ligament is attached anteriorly to every vertebra and, as the name suggests, runs longitudinally throughout the spine. The same for the Posterior Longitudinal Ligament with the difference that it covers posteriorly. (Agur & Dalley 2014, 22.)

## 2.5 Nerves of the lumbar spine

In the literature the lumbar spine's nerves are mentioned as lumbar plexus, which is a formation of all the spinal nerves that go through T12, L1, L2, L3, L4. The nerves in the plexus that are most important and most linked with LBP are the lateral femoral cutaneous nerve, the obturator nerve and the femoral nerve. A small part of L4's nerves are connected with L5 and together with the sacrum's neural tissue, the sacral plexus is formed. In Figure 5 the formation of the plexus is shown. (Agur & Dalley 2014, 52.)

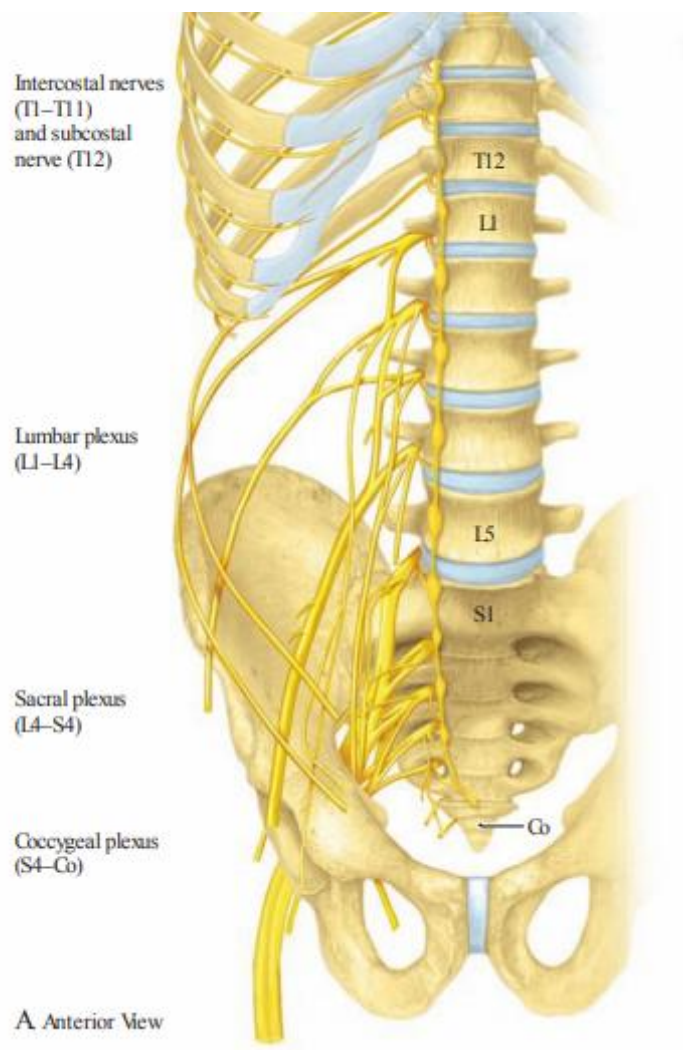


Figure 5. Overview of the innervation in the lumbosacral region. (Agur & Dalley 2014, 51)

## 3 PAIN

### 3.1 Definition of pain

The sensation of pain is a defense mechanism present in most living organisms that protects from harmful surroundings or further harm. It is a concept that has been studied by the healthcare system due to the huge loss of money that it causes. This is happening because pain decreases the quality of life and hence productivity and an increase in sick leaves. Although it has been researched thoroughly and for many years health care professionals have yet to find the absolute treatment for patients who suffer from pain. Professionals believe that lack of research in the physiological mechanisms of pain are responsible for the fact that the ultimate remedy has not been found. The definition of Pain that has been officially published by the international association for the study of pain (IASP) is: an event that causes discomforting feelings, emotional and/or sensory. It is linked with tissue damage that recently occurred or will soon occur. However, it is important to mention in the definition that individuals without the ability of speech or expression of pain must be carefully approached and treated. Pain is a subjective concept that human beings understand and establish, according to injury related experiences, from their day of birth. (Bernstein 2020, 813.)

### 3.2 Physiology of pain

Basically, the mechanism of pain takes place through three actions. These actions are transduction, transmission, and modulation in the presence of a harmful stimulation. More specifically, when transduction is happening the nociceptive pathways occur in the following order: initially, the stimuli is translated into chemical compounds, then these chemical compounds and synaptic cleft events are transformed into electrical messages in the neurons and, lastly, the electrical messages are transferred in the synapses as chemical messages. So, after transduction is completed the mechanism that follows is transmission. This action is responsible for transmitting the electrical message through the neuronal pathways. More specifically the neurotransmitters in the synaptic cleft send information to the next cell through one's post-synaptic cleft to the next one's pre-synaptic cleft. Lastly, the modulation mechanism is active through all

the levels of nociceptive pathways by regulating the “movement” of the information up or down (from or to the brain center). Hence all these actions combined result in the sense of pain that was initiated from a stimulus which caused a reaction. (Yam, Loh, Tan et al. 2018, 2164; Dalens & Storme 2019, 180.)

Although biologically pain is a stimulation that foretells tissue damage in a body part/s it is also a sensation that affects the emotional state. So a question arises from this idea. If the stimulus is pleasant should it be called pain even where it is related with tissue damage? From that question IASP set the necessity of a different approach to the term pain. For example, in a remarkable amount of people mild pricking is a pleasant feeling, hence it should not be defined as pain. (Olson 2015.)

Furthermore, it is very likely that individuals may feel pain without any tissue damage incident or pathological reason. Usually this occurs due to psychological issues. Hence if someone expresses the sensation of pain and there is not any injury or pathological cause, it must be considered as pain and be treated. This concept is mentioned in the definition of pain to avoid the creation of bias that ties it with physical stimuli. (Website of the International Association for the Study of Pain 2020.)

### 3.3 Different types and classification of pain

Because pain is a complex and multi-dimensional concept, researchers and health professionals classify it in many ways depending on the purpose and approach. For example, depending on the intensity, the terms severe, moderate and mild are used. Another way is according to the location (shoulder, stomach, low back etc.). When there is the need to define the quality of the pain, words such as sharp, nauseating and burning are used. Moreover, to categorize it according to the duration someone may meet the terms: intermittent, persistent, and transient. Lastly, words related to the emission pattern (generalized, localized, superficial, deep). However the most used terminology is to define the pain as cancer, chronic or acute. Obviously cancer pain is used when the cause of pain is due to cancer. Then on one hand acute pain is a warning of potential harm, and on the other hand chronic is abnormal and it is very likely that it is not related with any potential damage. (Loeser & Treede 2008, 473–477.)

There are also more accurate and scientific ways to classify pain which focus on the physiological mechanism of the human body. Firstly, nociceptive pain which occurs when there is potential or actual tissue damage. The mechanism of nociceptive pain occurs when neural or peripheral nociceptive pathways are activated due to damaged tissue or potentially damaged tissue. For example, burning or joint pain due to strenuous activity. (Woolf 2010, 3742–3744.)

Secondly and in opposition, neuropathic pain indicates injury in neural tissue or malfunction in the central or peripheral nervous system. In most of the cases it is referred as a shooting or burning sensation. Some examples are diabetic neuropathic pain, trigeminal pain etc. Thirdly, hypersensitivity to pain and inflammation indicate inflammatory pain such as in rheumatoid arthritis. Lastly there is functional pain which is manifested by being hypersensitive to pain because of impairment in the processing of the input. In most of the cases of this type of pain the patient may suffer from an unidentifiable neurological deficit or abnormalities in the peripheral nervous system. Some examples that belong in this type of pain are fibromyalgia, non-cardiac chest pain, or in general symptoms that appear without any pathological indication. (Doleys 2014, 10.)

Another type of pain which is still under discussion is psychogenic pain. It is mentioned as last as the medical community has not decided yet if it is a useful concept for classification. This type is also met with the name of Pain Disorder. However it is widely used and processed as a criterion when professionals are exploring the core of the pain in some patients. The concept of psychogenic pain was introduced initially as a matter that needed research to identify unidentified causes and symptoms. For example, the first research article that was conducted correlated to psychogenic pain and was to identify the source of low back pain. Thus the term psychogenic pain is used to address pain that is immediately affected by psychological factors, in some cases low back pain or stomach pain. (Doleys 2014, 14.)

## 4 LOW BACK PAIN

### 4.1 Understanding the wider concept of low back pain

The term low back pain is used when someone is experiencing pain sensation, most of the time a sharp radiating ache, in the area of the body which is located on the back and below the ribcage. In scientific literature one can meet the term Sacro Lumbar in reference to the same region. The terms that are used to classify low back pain issues according to the time frame that sensation lasts are acute, sub-acute and chronic. Acute stands for pain that lasts less than 6 weeks, sub-acute for pain 6-12 weeks and chronic for pain that lasts more than 12 weeks. (Delitto et Al. 2012. 42.)

Aching in the lumbar area occurs regularly and it is an issue where most of the time its cause cannot be specified. In the literature we meet this term as nonspecific low back pain. Statistics have shown that the majority of nonspecific acute low back pain cases show significant improvement in only a few weeks without the application of any specific treatment. Thus the professionals who have as a responsibility to assess the causes and the risk factors must focus on and reveal the core that leads to the condition. For example, increased stress during their daily routine and co-existing health conditions. (Bento, Genebra, Maciel et al. 2020, 79.)

It stands in high importance that these matters be recognized and classified, to avoid the possibility of the issue becoming chronic. Moreover, the cases with acute or chronic pain in the lumbosacral region should be counselled to stay as physically active as possible, only if, of course, the physician or the orthopedic surgeon haven't found any health condition that will be aggravated by activity. In addition, the process of decreasing or eliminating the chronic nonspecific low back pain must be approached multidimensionally and with professionals from almost all the fields of the healthcare sector, such as physiotherapists, orthopedic surgeons, physicians, occupational therapists etc. Furthermore, it is wise to avoid surgery. It should be performed only if there are severe neurological issues or the development of cauda equina syndrome. (Golob & Wipf, 2014, 3; Buchbinder, Tudler, Öberg et al. 2018, 2384.)



#### 4.2 Epidemiology and prevalence of low back pain

According to recent epidemiological and prevalence studies, low back pain has been ranked in one of the highest places among common health problems. 50-80% of adults will suffer from LBP at least once during their lifetime. (Rubin Di, 2007, 353-371).

Although the health society has supported the idea that males are likelier to experience LBP, a recent systematic literature review of prevalence has proved the opposite. It analysed epidemiological statistics in the following countries: Canada, United States of America (USA), Sweden, Belgium, Finland, Israel, and Netherlands. In order to assist the reader to gain a more international picture of this matter, a statistic article that was published in the International Journal of Advances in Medicine is mentioned to show the prevalence of LBP in India. Figure 6 demonstrates the statistic difference between the genders. The table has no intention to create any bias about which sex is likelier to experience LBP but to offer a greater understanding about how multi-dimensional the nature of this health condition can be. (Fatoye, Gebrye & Odeyemi, 2019, 2.)

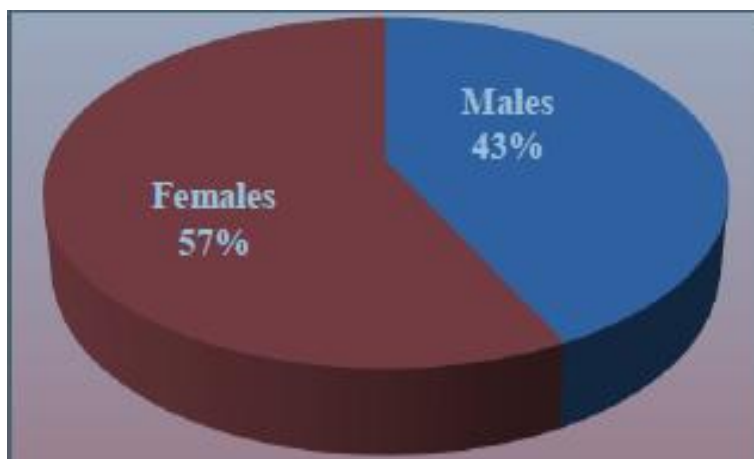


Figure 6. Sex wise distribution of patients. (Jella & Jella 2018. 2)

#### 4.3 Chronic musculoskeletal pain

CMP is the abbreviation of Chronic Musculoskeletal Pain. This concept refers to pain in tissues, bones and joints that persists for more than 3 months. Two very common examples of CMP are: chronic low back pain and fibromyalgia. Research has shown that in most of the cases there is a secondary pathology existing or there are consequences from the duration. Research has shown that during these three months the patient is very likely to develop fear of movement, anxiety and/or hypersensitivity to pain as secondary pathologies. This assists the pain in leading to disability and chronification of the existing issue. (Booth, Moseley, Schiltenwolf, Cashin et al. 2017.)

According to a recent hypothesis, health care professionals and researchers can try to create a deeper understanding of how multi-dimensional pain is. The idea is that when treating pain, apart from the nociception mechanism, they should take into consideration many other parameters as well, such as cognitive and environmental factors. In addition, the brain's plasticity (it is a skill of the brain that it can change continually) has an immediate and strong bond with chronic pain. There are two different ways that this plasticity affects our brain in correlation to chronic pain. The first one is non-associative which changes the picture of the stimulus that causes the pain after repetitive exposure to it. For example, habituation is the gradual decrease of the response to a specific stimulus. On the other hand, sensitization is when the response increases, and it occurs when there is neural tissue damage or disability. The treatment of this focuses on maintaining the quality of life through exercise and decreasing the attention paid to the secondary pathologies. (Moseley & Vlaeyen 2015, 35-38.)

#### 4.4 Non-specific low back pain

Non-specific low back pain, met also as axial LBP or mechanical LBP, is referred to aching in the lumbar region that clinicians are not able to specify the underlying cause of. Hence the treatment focuses on decreasing or eliminating the level of pain, avoid any complication caused from it and maintaining functional capacity as much as

possible. According to the literature there is evidence that this issue is not treated efficiently, and it is quite common for the patients resort to the use of opioids. NSLBP is encountered in all ages, serves as a huge issue among healthcare professionals, and is typically difficult to treat. Primarily the techniques used for treatment are patient education, therapeutic exercise, and experimental methods, for example Manual Lumbar Traction. (Wegner, Widyahening, Tulder et al. 2013.)

Literature underlines as a major issue the misuse and sometimes overuse of M.R.I, the use of opioids, and surgery among patients who suffer from NSLBP. Therefore, researching non-invasive and non-medicative treatment is of great importance. (Maher, Underwood & Buchbinder 2017. 736-747.)

#### 4.5 The economic effect of Low Back Pain

Moreover, the World Health Organization (WHO) acknowledge that low back pain has an enormous economic cost and is one of the main reasons for sick leaves. (WHO, 2013) Research done in 2005 correlates the transition from acute LBP to chronic LBP with money for employers and employees. Statistics have shown that in the USA more than 50 billion US dollars are spent annually due to delayed return to work and costs for treating LBP. Moreover, in the UK and in the Netherlands the amount is 11 and 5 billion dollars respectively. The conclusion of the study is that factors that assist a solid prognosis are very important for prevention. It is crucial for healthcare professionals to build the intervention plan according to these factors and to the populations that have many or severe risk factors. (Steenstra, Verbeek, Heymans & Bongers 2005, 851-860.)

#### 4.6 Risk factors

Although this health condition has been researched for many years and by many different researchers, the causality is still unclear and unclassified. On the other hand, what has been done is to identify and categorize thoroughly most of the factors that

increase the risk of this condition occurring or reoccurring. The nature of these factors can almost be characterized as chaotic as the evidence for them is limited.

Although, as mentioned above, the literature provided in WHO guidelines which support the idea the necessity of examining factors such as: posture, aging, genes, labour and its consequences, lifestyle, weight, working environment, and use of tobacco products. (Hochshuler 2008; Clark & Horton 2018, 2302.)

Moreover, they are commonly used in the research methodology as criteria to create the examined sample. Figure 7 is an example of the abovementioned factors.

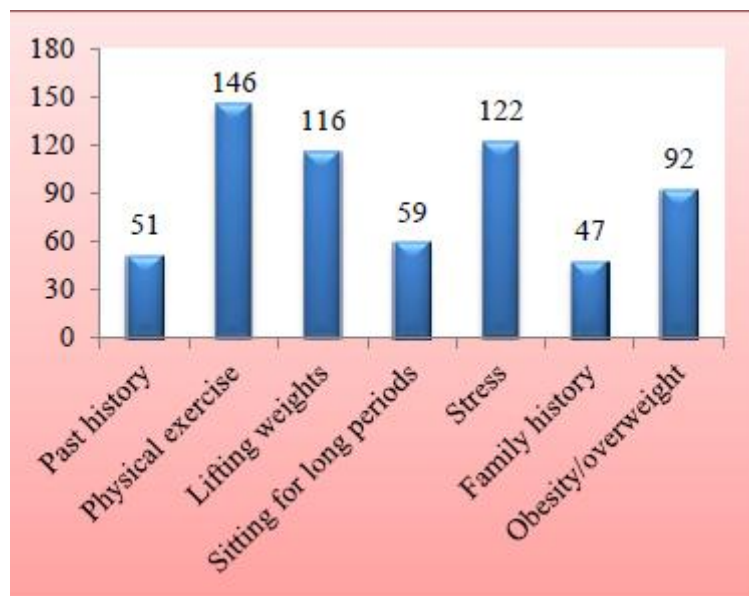


Figure 7: Risk factors for LBP. (Jella & Jella 2018. 3)

While humans are aging, changes in our body structure (such as the spine) are a natural outcome. Often this leads to development of health issues (e.g. spinal degeneration and decrease of the intervertebral space. This has a high risk of causing pain as the surrounding structures are affected. To conclude, the elderly are more prone to spinal pain than younger people. According to the literature especially after the age of 60 if osteoarthritis coexists. (Wong, Karppinen & Samartzis 2017. 12-14.)

There is a satisfying amount of research that supports the correlation between genetics (nucleotide polymorphisms), and degeneration of discus pulposus and the growth of osteophytes. This genetic abnormality is normally inherited. However, the relationship between genetics and low back pain is a fact the exact mechanism of which needs further research to be clearly identified. (Bonekey 2013, 301.)

Nowadays many jobs involve either bending and lifting weight in uncomfortable positions (e.g. nursing or office work), or prolonged sitting. These jobs have proven to contribute to musculoskeletal pain (such as LBP, neck pain and shoulder pain). Moreover, lack of good ergonomics and poor body awareness cooperate to increase the symptoms. It is common as well for a lack of muscle strength and structural support to exist. (Yang, Haldeman, Lu & Baker 2016, 459-472.)

There is a high level of evidence that supervised physical exercise and a general moderate level of exercising assists the prevention, occurrence and reoccurrence of LBP symptoms. Moreover, exercise maintains the functional ability to a satisfying level. So a lifestyle in which the patient is mainly spending time sitting, and especially with bad posture, is a factor that many practitioners take into consideration when assessing the core elements that lead to low back pain. (Chou et al 2016, 169.)

There is much research available that examines the relationship between high values of BMI and LBP. However there is not any clear result that confirms the absolute correlation of these two factors. On the other hand, if obesity is accompanied with other factors, this aggravates the symptoms and makes the rehabilitation a more difficult task. Being overweight often means that there is lack of balance in nutrition and exercise. (Peng, Perez & Gabriel 2018, 294-303.)

It is well known among the health care society that pregnancy causes significant alterations to the body. According to the literature one of the sections that is affected is the musculoskeletal system. This occurs due to hormonal and biomechanical changes. Hormonal imbalance may affect the ligaments by causing laxity and therefore alternations to the joints. The biomechanical changes are hyperlordosis and excess anterior tilt in the pelvic area. This may happen because of a shift of in the centre of gravity. Furthermore, metabolic factors are linked to low back pain during pregnancy, such as alterations to the vascularity of the area that can cause nutritional insufficiency. To summarise, LBP and pelvic girdle pain are among the most common issues that women in pregnancy may complain of. (Casagrande, Gugala, Clark & Lindsey 2015, 539-549.).

It is important to mention that, according to the literature, in this category belong different aspects that amplify acute to chronic low back pain and are not factors that are initially linked with the general causality of LBP. Some examples of these factors are depression, psychological distress, passive coping strategies, fear-avoidance, education. (Ramond et al 2011, 12–21.)

#### 4.7 Pathophysiology of LBP

The following text analyzes the equilibrium between the spinal structures. The caudal flexible part of an axial structure supporting the upper body (excluding the spine) and internal organs over a bipedal stance which is formed by the lumbar spine. The base of the spine is the sacrum, which joins with the pelvis and makes the connection with the lower body. Although the spine can be considered weak according to its morphology, it can bear remarkably heavy loads at different angles. It also has the ability to support forward gravitational movements by keeping the natural lordosis. In opposition to the thoracic area, the lumbar region does not have side support (thoracic region = thoracic vertebrae and ribs). This allows it to have more freedom in rotational movements. This happens because of the “wise” connection between the spinal vertebrae and the ability to distribute the loads throughout its whole length, providing greater weight durability. The parts of the bone which are better vascularized, called the parallel lamellae, are connected with each other. This provides the ability to the spinal vertebrae to enlarge or decrease depending on the need. Hence the spine has a better biomechanical distribution of load. (Urits, Burshtein, Sharma, Gold et al. 2019, 23.)

Repetitive eccentric movement accompanied with excess loading in the Sacro Lumbar region leads to microtrauma and small tears of the annular fibers. This may cause lack of nutrition and dehydration of the nucleus pulposus, meaning that the cushion mechanism of the low back is not functioning properly. Moreover, the small tears in the annulus fibrosus allow to the nucleus to move out, cause nerve root compression or irritation and radiating pain to the leg. (Li Fredrickson & Resnick 2015, 1896-1902.)

#### 4.8 ICF

The WHO founded the ICF in 2001 to set and establish international standards to classify, explain, document and measure functioning and disability. The abbreviation ICF stands for International Classification of Functioning, Disability and Health. It is a tool that health care professionals use in order to understand each other internationally. In addition, it assists the process of rehabilitation planning. Although it is widely used and researched and it is famous for its positive outcomes, it is still complex to use and this affects its operability. (Nguyen Stewart Rosenbaum et al. 2018, 225.)

The word ‘Functioning’ in ICF is a spectrum term that encompasses the components of Body Functions, Body structures, and Activities and Participation. On the other hand, ‘Disability’ is used to define impaired functions and structures, and restrictions in activities and participation. Although the framework associates and classifies health issues (e.g. disorders, syndromes, or diseases) its actual goal is to create a correlation between all the components and how they interact. If one component in the framework changes then all the rest of the components change or are affected. Figure 8 and 9 is used to provide a better picture of the immediate relation between the components. (Bickenbach, Cieza, Rauch & Stucki 2012, 4.)

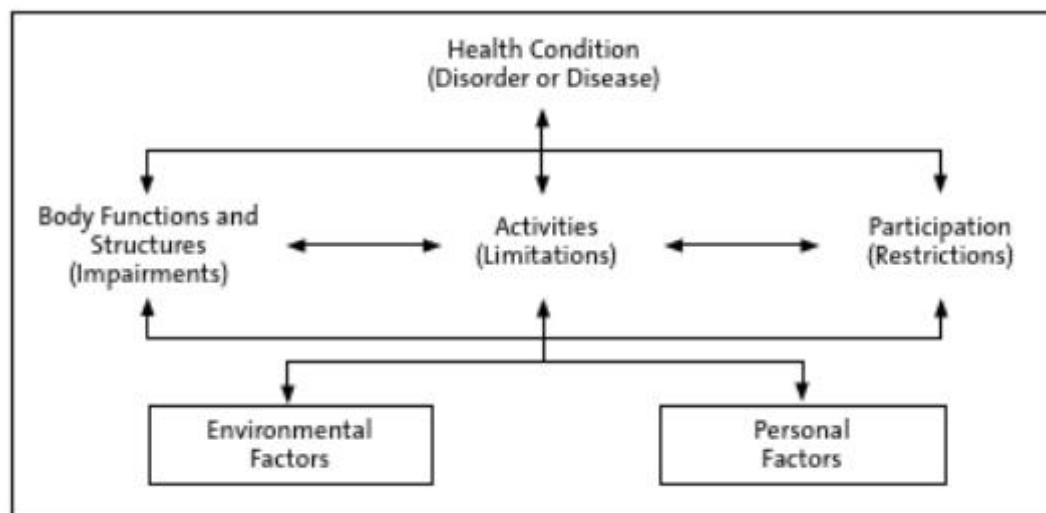


Figure 8. ICF. (Bickenbach, Cieza, Rauch & Stucki. 5)

Definitions of the components of the model of functioning and disability	
Positive	Negative
<b>Body Functions</b> are the physiological functions of body systems (including psychological functions)	<b>Impairments</b> are problems in body functions or structures such as significant deviation or loss
<b>Body Structures</b> are anatomical parts of the body such as organs, limbs and their components	
<b>Activity</b> is the execution of a task or action by an individual	<b>Activity limitations</b> are difficulties an individual may have in executing activities
<b>Participation</b> is involvement in a life situation	<b>Participation restrictions</b> are problems an individual may experience in involvement in life situations
<b>Facilitators</b>	<b>Barriers</b>
<b>Environmental Factors</b> make up the physical, social and attitudinal environment in which people live and conduct their lives and can act as facilitators or barriers	
<b>Personal Factors</b> are the particular background of an individual's life and living and comprise features of the individual that are not part of a health condition or health state	

Figure 9. Functioning and Disability. (Bickenbach, Cieza, Rauch & Stucki. 6)

The reason that the ICF topic is mentioned in this thesis is that the WHO considers it an important instrument for data collection. Hence the exchange of up-to-date knowledge at an international level provides help to improve the education, the quality of interventions and the methodology for research in LBP, as it is considered to have reached epidemic levels. It is still an ongoing project, but the WHO has already created an internationally accepted evidence based ICF Core Sets for low back pain. (Website of ICF Research branch 2020.)

## 5 MANUAL LUMBAR TRACTION

### 5.1 Definition of manual traction



Lumbar traction is a method of treating spinal infirmities through the physical manipulation of the spine. Traction specifically denotes the stretching or separating of a given part or parts of the spine by the application of mechanical force using the weight of the body, pulleys, or additional weights. It has been used since early antiquity for the treatment of various spinal conditions. This method increased in reputation from the 1950s onwards, with significant contribution from James Cyriax (Cyriax 1982). Especially for the treatment of lumbar disc herniation. (Website of Physiopedia.)

## 5.2 Types of manual traction

Continuous traction, also known as bed traction, involves the use of light weights to separate the spinal structures. However this process is thought to be impractical as the average patient would not be able to endure the weight required for separation of the vertebrae for long periods. As such light weights are used for long periods, as much as several hours. Sustained traction, also known as static traction, makes use of heavier weights for shorter periods of time. This can vary from some minutes up to an hour. Intermittent traction involves the application and relief of traction at predetermined intervals, with the use of a mechanical unit in place of weights. It is similar to sustained traction in terms of force and the period of time that it is applied. Manual traction involves the manipulation of the patient using the hands of the clinician, or else a belt, to apply force by pulling on the patient's legs. This is done either for a few seconds or as a quick thrust. (Knight & Draper 2008, 13-16.)

Autotraction makes use of a purpose-made table divided into two independently rotating sections. The traction force comes from the patient by pulling with the arms or pushing with the feet. This technique has seen positive results but without a variation in the lumbar disc herniation in terms of size or location. Positional traction involves placing the patient in different positions with the assistance of blocks, pillows, or sandbags to create a longitudinal force on the spinous process, often using lateral bending. This only affects one side of the spinal segment. (Behrens 2020, 14-20)

Gravity lumbar traction creates a traction force from the weight of the lower half of the body by securing the patient to the treatment table with a chest harness and tilting said table to a vertical position. (Website of Physiopedia.)

### 5.3 Mechanical effects

Traction therapy could be clinically beneficial for various possible reasons and as such many theories have been put forward. For example, it is thought that the position of the nucleus pulposus relative to the posterior annulus fibrosus changes by distracting the motion segment. Studies done during traction therapies examine the kinematics of the lumbar spine support this explanation. It has also been understood that traction can reduce nucleus pulposus pressure and increase foraminal area as well as separating the vertebrae. Despite this, when the patient resumes an upright, weight-bearing posture, it is doubtful that the mechanical changes discerned while in a prone position will last. The mechanobiology of the motion segment and neural tissues are affected by traction and this is the more likely cause of any sustained clinical benefit. Animal studies have shown that the mechanobiology of the disc is sensitive to the quantity, frequency, and duration of loading. As such it must also be kept in mind that different traction therapies exert different forces on the spinous process thus making it harder to reach definite conclusions about the clinical efficacy of traction. (Iatridis MacLean & Ryan 2005, 557-565.)

This knowledge relating to disc mechanobiology underlines the fact that different traction therapies cannot be considered equal. This is because each mode of traction will distract the spine differently thereby changing the influence on the disc and joint mechanobiology. The differing effects of the variables of force and duration have not been considered in most systematic reviews. It is also possible that some traction methods can stimulate disc or joint repair while others can cause tissue degradation. More often than not patients involved in traction trials present a mix of symptoms including back-dominant LBP, leg-dominant LBP, or the two together. Any pain in a patient presenting only dominant LBP and no radiculopathy likely has a sclerotomal source, such as facet joints discs. In the case of sciatic pain, it may be predominantly of neural origin, even when caused by disc herniation. Traction therapies may affect these

conditions in different ways but there is not enough evidence to support the relevant hypotheses. (Gay & Brault 2008, 234-242)

## 6 AIMS AND OBJECTIVES OF THE THESIS

The aim of this thesis is to discover any clinical effects generally and more specific, effects in the pain level of manual traction in patients who suffer from low back pain. This thesis will be conducted as a systematized literature review.

The objective of this thesis is:

- How does manual lumbar traction affect the pain level of patients with low back pain?

## 7 ANALYSIS OF THE LITERATURE REVIEW PROCESS

The systematized literature review is the methodical appraisal of studies carried out by the researcher composing the review. In order to be systematized such a review should be based on an unambiguous, clearly expressed question for which pertinent studies will be evaluated in order to answer the question, thereby assessing the value of said studies (Khan et al, 2003. 118-121).

The research questions are generally articulated through the identification of key terms concerning the topic to be evaluated. These terms, combined in various ways, develop a search strategy. The PICO framework is advised for the formulation of research questions (Sayers, 2008, 136).

P = Population: The specific population to be scrutinized.

I = Intervention: Intervention as a means of addressing the given issue

C = Comparison: A comparison of interventions and their effects

O = Outcome: The outcomes of our area of scrutiny

(da Costa Santos et al, 2007, 508-511)

The variety of relevant terms can be used in searching for and locating pertinent research material. For example, manual lumbar traction AND pain, AND effectiveness. Following upon the accomplishment of an efficient search strategy is the identification of relevant publications. After the more pertinent material is gathered and the less excluded, the researcher will assess the value of the studies to be used.

## 8 METHODOLOGY

### 8.1 Construction of the search

The search term was created having a limitation in including only research not older than 10 years, and only human and English written studies. As the main title was traction OR manual traction OR spinal traction. The population term was any human, the outcome terms were pain OR self-perceived pain OR self-perceived discomfort OR strain OR quality of life, there was not any term used for comparison as it is unnecessary according to the aim of the thesis. For the literature search, the PubMed the databases was selected. The complete search term was designed as follows:

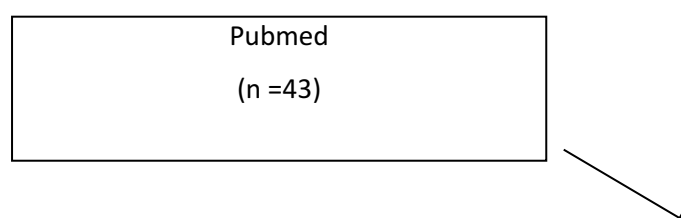
```
((((low back pain[Title/Abstract]) OR (low[Title/Abstract] AND back[Title/Abstract]
AND pain[Title/Abstract])) OR (spinal structures[Title/Abstract])) AND
(((traction*[Title/Abstract]) OR (manual traction[Title/Abstract])) OR (spinal
traction[Title/Abstract])) AND (((traction*[Title/Abstract]) OR (manual
traction[Title/Abstract])) OR (spinal traction[Title/Abstract]) AND ((y_10[Filter]
AND (humans[Filter]) AND (english[Filter]))) AND ((therapy[Title/Abstract]) OR
(treatment[Title/Abstract])).
```

## 8.2 1st stage of the Study selection

The above-mentioned search term provided me with 43 hits. After assessing the titles and abstracts, 11 studies were selected to check for the following stage of review (searching through the methods and results sections). The remaining studies, 14 systematic literature reviews/commentaries, 15 unrelated studies (which focused on imaging assessment, massage therapy, classification or no pain as outcome) 1 case-study and 2 cross-sectional studies were excluded, because of providing irrelevant information (no interventions) concerning manual traction and its effect on pain level.

## 8.3 2nd stage of the Study Selection

Out of 11 studies selected for inclusion in this stage of the literature review, only 7 studies were publicly free and available. Therefore, only the methods and results sections of these 7 articles were reviewed. After, comprehensive inspection of 6 of the 7 studies were excluded because they did not fulfil my inclusion criteria (manual traction as the intervention). So, the only study written by Kuligowski et al. was the only research remaining for review. (Kuligowski, Debiek-bak & Skrzek 2019.) Figure 10 shows the exact process and clarifications mentioned above.



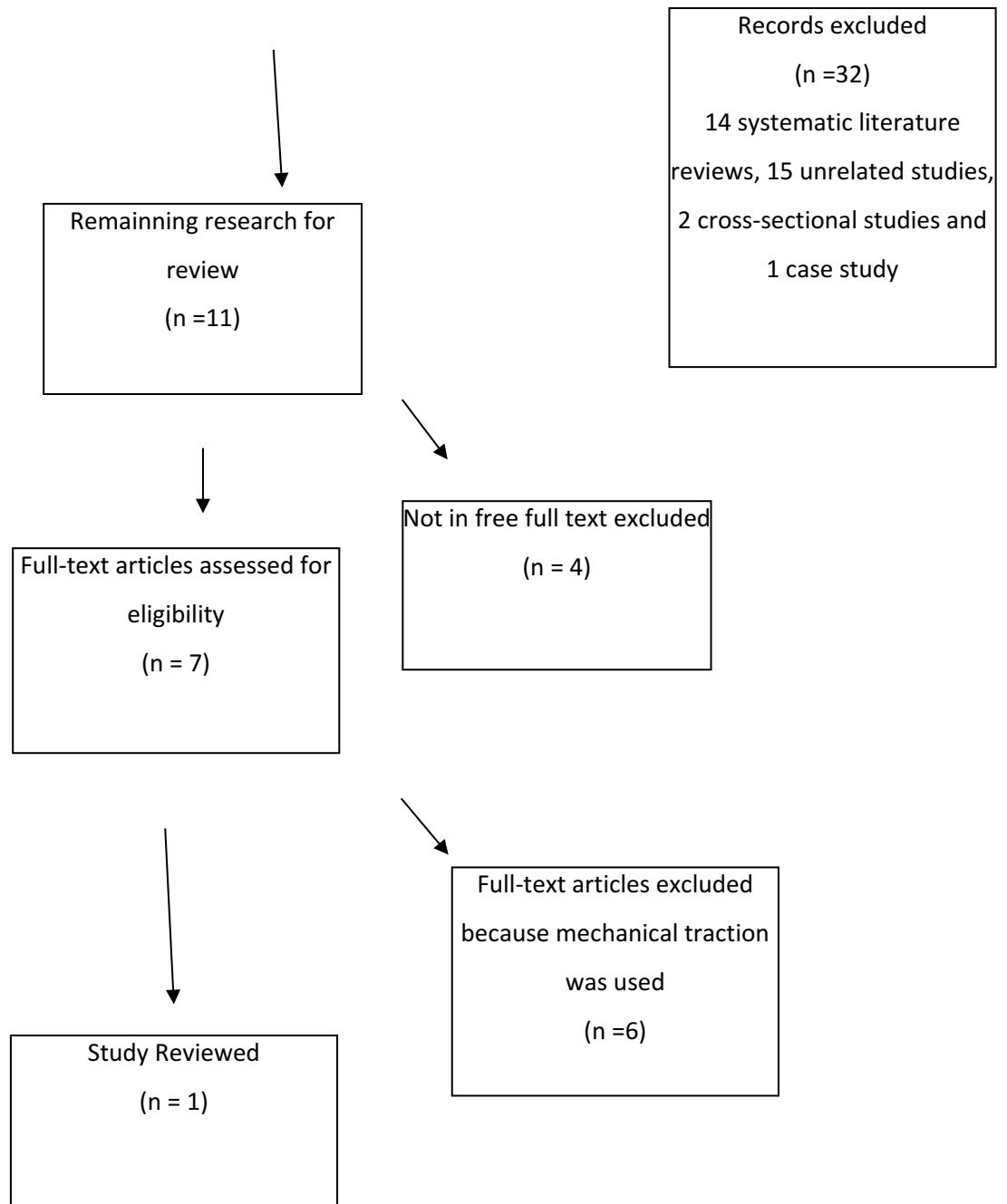


Figure 10. Selection Flow Graph.

## 9 RESULTS

Kuligowski et al. investigated the effects of manual lumbar traction on patients' pain levels with low back pain. The authors supported the theory that manual lumbar traction can bring some effects onto patients' pain levels with low back pain. Their results showed that the only statistical significant differences were in the (ODI) disability index values and the (NRS) pain assessment numeric value before and after the intervention, especially in the group (EXT)(divided EXT and PRO according to the level of their intervertebral intrusion). The results of the EXT group in ODI and NRS were 20-54/5-7 before and 8-40/2-4 after the intervention, respectively. However, there is no such research to support the idea solidly. According to the authors of the research that was reviewed, there is the need for a search in wider populations in order to support it. The development of equipment and the improvement of daily comfort expectations in the modern era has reduced the amount of physical activity attempted by humans, reducing their muscle mass. Consequently, the quantity of individuals complaining of back agony has expanded after some time. Many scholars argue that the number of sufferers has continually changed depending on how physiotherapists respond to the circumstances. However, most of the therapists have come to a joint resolution agreeing with the general perceptions. (Kuligowski, Debiek-bak & Skrzek 2019.)

## 10 CONCLUSION

Based on the literature review, it was found that the results were arguing that many patients with low back pain had registered differences relating to lumbar traction use. However, the statistics have shown a decrease in pain. Moreover, manual lumbar traction is a technique used by many practitioners to decrease low back pain. Clinical therapy, physiotherapy, muscular therapy, foot treatment, and manual treatment are essential for the methodologies utilized to treat ongoing back torment.

## 11 DISCUSSION

Manual lumbar traction is commonly used among practitioners as a treatment modality for a wide variety of musculoskeletal issues. However, the treatment mechanism is far from something fully comprehended. Firstly, the reason I got motivated to start writing the present literature review is mainly to examine what level the most recent evidence has reached in order to understand that mechanism. Second was the desire to find a correlation between manual lumbar traction and decrease of pain. So, once the idea was solid in my head the process was initiated.

Although the initial idea was to create a systematic literature review that researches the effects of manual lumbar traction in patients who suffer from non-specific low back pain. After the initiation of the process I realized that there are not enough surveys to support it. So there was a given generality in the low back pain concept. After I started the investigation of what a literature review is. I was aiming for a high-quality review. I subsequently understood that the time and resources that were offered for a bachelor thesis were insufficient for such an undertaking. Moreover, the lack of high-quality evidence that is available for review was a significant obstacle.

The result of all these factors, together with the concrete selection criteria, was to be left with only one study to review. This statement makes clear that there is a need for more evidence. Nevertheless, manual lumbar traction as an intervention is very often used to decrease suffering in patients with back pain. According to Kuligowski, Debiek-bak & Skrzek provided evidence that there was a significant difference in how the patients were feeling after the treatment, by using the (ODI) Oswestry Disability Index questionnaire and Numeric rating scale – NRS (a scale that evaluates numerically the subjective sensation of the pain before and after the intervention). (Kuligowski, Debiek-bak & Skrzek 2019.)

Nevertheless, the limitations are obvious. There is a clear lack of information on the topic of manual lumbar traction effectiveness as, although the results from the evaluated study do not clearly support that manual lumbar traction has specific effects in pain level. This technique is still widely used and even taught in universities.



Hoperfully, this thesis is able to create the curve for further research on this matter. More specifically, it would be interesting the literature to be provided with evidence from high quality RCTs with more specific topics. Such as subjective feedback in the effectiveness of manual lumbar traction in non-specific low back pain. NSLBP is an issue affected a lot from the patient's own perspective. So why not seek the correlation between the above-mentioned parameters (Balagué F., Mannion A, Pellisé F. & Cedraschi C. 2012, 482-491).

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