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LOW BACK PAIN PREVENTION FOR NURSING STUDENTS: A KETTLEBELL INTERVENTION

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The purpose of this thesis is to educate and provide information to promote nursing students to take action in Low Back Pain (LBP) prevention. LBP is a high risk in nursing and prevention measures are recommended prior to starting the work. LBP is a debilitating musculoskeletal condition which affects all parts of the world. Prevention measures are many and this thesis aims to promote the Kettlebell training as one of them. The kettlebell is a cast-iron ball with a handle. It has become increasingly popular over the years for training and competitive purposes. Studies have been done on the positive outcomes of kettlebell training, including results in reduced LBP. Kettlebells are accessible in Satakunta University of Applied Sciences and the author aims to encourage nursing students to take advantage of this opportunity.

An exercise package was created to provide nursing students with basic kettlebell exercises that can be done without previous experience. The exercise package was implemented for a one hour session with voluntary nursing students. The session included a lecture on LBP risks, outcomes and preventative measures followed by a practical kettlebell workout. Feedback received from nursing students was positive and the majority of respondents stated that the information regarding LBP was useful and would consider continuing kettlebell training independently.

CONTENTS

“Lack of activity destroys the good condition of every human being, while movement and methodical physical exercise saves it and preserves it”

-Pluto.

1 INTRODUCTION

LBP is a world-wide problem affecting children, adolescents and adults. A LBP episode may last seconds but cause years of pain and stress and possibly disability as those who experience LBP are likely to experience it again (Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1636). Despite progress in LBP research, more than 80% of all LBP cases are labelled non-specific (Hoy, Brooks, Blyth & Buchbinder 2010, 775) and disability caused by LBP is on the rise (O'Sullivan 2011, 1). Specific risk factors and causes are numerous and include anxiety, static positions and lifting heavy loads. Individuals working in manual jobs are said to have the highest possibility of developing LBP, nursing being high on the list (Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1637).

LBP is considered the most limiting musculoskeletal problem for nurses today (Maul, Läubli, Klipstein & Krueger 2003, 497; Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1636; Roupa 2008, 219). Work demand, poor ergonomics and personal factors create numerous risks for employed nurses, some of which are difficult to avoid, including: patient transfers or static postures. Studies also show that not only are employed nurses at risk, but LBP prevalence has been seen in the nursing student population as well (Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1636). Fortunately, despite the risks and high prevalence rates, LBP can be prevented (Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1643). Numerous factors need to be considered when developing a program to prevent or improve LBP, including client's goals, current physical condition and level of self-efficacy. Therapeutic exercises have been used by physical therapists as a way to improve and further prevent musculoskeletal disorders, specifically LBP.

Functional training is form of therapeutic exercise which can be used to prevent and improve LBP (Silver & Morin 2008, 76). Various types of functional training options are available, one of which is Kettlebell training. The Kettlebell is a useful tool for functional training (Liebenson 2011. 542; Cotter 2014, 3) and has been used to improve LBP and other musculoskeletal disorders (Jay et al 2011, 196). The kettlebell has been around for hundreds of years in Russia, but only recently did it start receiv-

ing attention elsewhere. Since early 2000, the Kettlebell has begun to soar in popularity and has not only been featured in various magazines and journals but has received credibility from well-known actors and athletes (McGill & Marshall 2012, 16-17). This iron-cast ball, once used to prove great strength, is now used to improve general aspects of physical fitness such as endurance, strength, flexibility and mobility. Despite its popularity, the kettlebell's different style of training has been questioned, as its exercises are different than that of traditional strength and endurance training. Awareness of the kettlebell and its benefits for overall physical condition as well as form of prevention for LBP needs to be further endorsed.

2 PURPOSE AND AIM OF THE THESIS

The purpose of this thesis is to educate nursing students about LBP and how to use the Kettlebell as a form of prevention. The kettlebell is both easy to use and available in most gyms. Currently at Satakunta University of Applied Sciences in Pori, Finland there are various kettlebells in the school gym, however no instructions, written or pictured, are available.

This thesis includes an exercise package which includes brief information regarding LBP including risk factors, outcomes and preventative measures, background information of the kettlebell and a kettlebell workout. The package will be tested for voluntary nursing students and feedback following the session will be used to modify the package as necessary.

3 ANATOMY

The musculoskeletal system is comprised of bones, joints and muscles (Tortora & Derrickson 2009, 198). These three components make up the functional human being, allowing individuals to move and manage daily tasks. For the purpose of this thesis anatomical information will focus primarily on the Lumbar region, as this is the site of LBP.

3.1 Spine

The spine provides support for the head, extremities, trunk and organs and is vital for the integrity of the human body (Waddell 2004, 160). The average human spine consists of 24 vertebrae (figure 1). Each vertebra belongs to one of three regions: cervical, thoracic, lumbar and sacrum In medical sciences, abbreviations are used to indicate a vertebra by using the first letter of the region and the number of its location, such as L1 for the 1st vertebrae in the Lumbar region. Along with the name, each region can also be recognized by vertebrae size and structure (Agur & Dalley 2009, 288). Vertebra size increases down the spine, as a result of load bearing necessity (Waddell 2002, 161). Cervical and lumbar are considered most mobile, while thoracic is noticeably stiffer. The sacrum and coccyx, also referred to as the tailbone, are made up of small vertebrae which are fixed together, allowing no movement (Agur & Dalley 2009, 288).

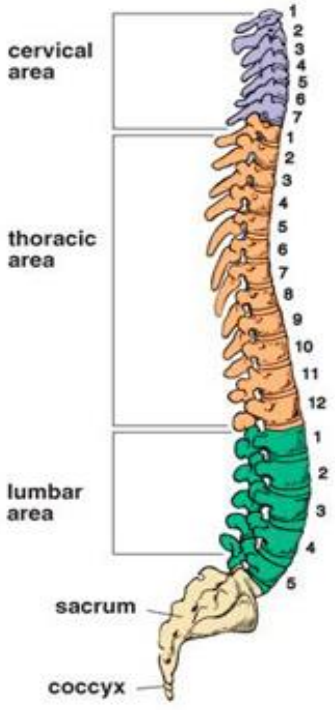

Figure 1. Spine separated in color according to regions. Website of spine surgery.

3.2 Vertebrae

The vertebra slightly changes in shape along the spine, but its bony parts serve similar purposes. The vertebrae bodies contain endplates above and below which are “po-

rous" as it has microscopic holes, while the body is "cancellous" (McGill 2007, 36.), also referred to as "spongy" by Mosby's Medical, Nursing and Allied Health Dictionary. The microscopic holes in the endplates allow for nutrient flow to the discs while the bodies act as load bearers and "shock-absorbers" (McGill 2007, 36). The exterior bony parts located posteriorly provide attachment sights for ligaments and muscles (McGill 2007, 41, 63), as well as provide protection for the spinal cord (Waddell 2004, 161).

3.3 Intervertebral disc

Intervertebral discs are located between every vertebra. These discs allow the spine to move and twist without stressing the vertebrae. Each disc is made of two parts: annulus fibrosis, the fibrous outer service, and nucleus pulposus, the "soft and highly elastic" center, (Tortora & Derrickson 2009, 219) and is best described as having a "gel-like character" (McGill, S. 2007, 44). The fibers of the annulus intertwine diagonally (McGill, S. 2007, 44). The mechanics of this structure allows for twisting of the spine to occur, however, while twisted, only half of the fibers tighten and bear load leaving the other half loose and vulnerable (McGill 2007, 44; Hamill & Knutzen 2009, 261).

The discs contain approximately 80% water, which dries with age (Norris 2008, 21). Throughout the day, compression applied to the spine causes a reduction in the water causing a minor shortening of the spine's overall height (Waddell 2004, 162). Proper sleep is necessary to allow the discs to regain the needed water content and height (Waddell 2004, 162).

These discs do not contain blood vessels, and as a result depend on the vertebrae to maintain a healthy metabolism (Norris 2008, 21; Waddell 2004, 162). This is best achieved through light loading and movement of the spine throughout each day to aid the nutrition flow (Waddell 2004, 162). As the discs are compressed nutrients enter from the vertebrae endplates and waste is removed. However, excessive loading on the discs can lead to cell breakdown and eventually tissue damage therefore a bal-

ance of loading needs to be maintained to keep the discs healthy. (McGill 2007, 44). Once damage occurs, the prognosis is often poor (Hamill & Knutzen 2009, 261).

3.4 Muscles and Ligaments

Muscles are vital for spine stabilization (Waddell 2004, 163; Norris 2008, 44). The muscles not only support but also allow for controlled fluent movements (Waddell 2004, 163). There are various ways in which muscles are divided, some according to muscle action, muscle size or location (Waddell 2004, 163; Norris 2008, 44). According to various sources, back muscles, abdominals and hip flexors play an important role in low back stability (Waddell 2004, 163; Norris 2008, 44; Sahrmann 2002, 65-73; McGill 2007, 49-62).

Currently, there are various discrepancies on which specific back muscles are considered important for the LB stability. Based on multiple resources it can be concluded that multifidus, erector spinae (Waddell 2004, 163; Norris 2008, 45, 48; Sahrmann 2002, 65, 67) and quadratus lomborum (McGill 2007, 62; Norris 2008, 49; Sahrmann, S.A. 2002, 68) play major roles. However, latissimus dorsi is also considered by some, as important (Sahrmann 2002, 65; McGill 2007, 54). The muscles of the back provide stability and permit controlled movements of the trunk. If one ventures deeper into the spine, there are smaller muscles including interspinales and intertransversarii which are important for proprioception (Sahrmann 2002, 67).

Iliopsoas is termed as the hip flexor and is made up of two muscles, psoas major and the iliacus (Norris 2008, 49). It is debatable whether this muscle provides stability to the spine or not (McGill 2007, 60). Most texts will however agree that the psoas major adds a compressive and an anterior shear force to the spine (Norris 2008, 49-50; McGill 2007, 61; Waddell 2004, 163) causing a forward pull of the vertebrae (Norris 2008, 50).

The rectus abdominis, also referred to as the six-pack, is very often commercialized as the end result of having the best core. Unfortunately, this message is misleading. The abdominal region includes four types of abdominals, external and internal

oblique, rectus abdominis and transverse abdominis, all significant in LB stability (Sahrmann 2002, 69-73; Norris 2008, 51; Waddell 2002, 163). These muscles, together, provide passive and active stability and help maintain posture control whether the individual is in motion or not (Sahrmann 2002, 69). If too much emphasis is placed on the rectus abdominis, it will cause the individual to activate this region as the primary stabilizer resulting in weakening of the other muscles (Sahrmann 2002, 69).

Ligaments are a form of passive support (McGill 2007, 62). Several ligaments are located along the spine anteriorly and posteriorly (figure 2). Ligaments are able to bear various movements and shorten or lengthen according to demand. These structures help maintain the integrity of the spine by keeping the vertebrae and discs in place while allowing flexible movement, such as twisting or bending (Waddell 2004, 162).

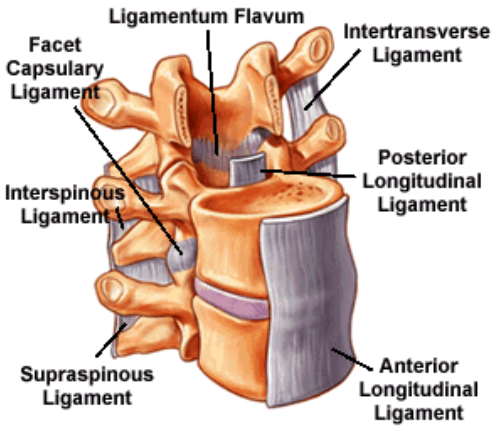

Figure 2. Portion of spine showing ligament names and location. Website of Colorado Spine Institute.

4 STABILITY

Stability is important for independent living. In order to complete simple or challenging tasks during the day, one needs some degree of stability. One's ability to maintain a position is constantly challenged during the day, such as a crowded street while walking or uneven surfaces while biking. Stability allows the individual to maintain

his position despite these disturbances (Dieen & Kingman 2013, 41). Many texts, including that of McGill and Norris have been written regarding spinal stability and the positive effects it has on low back pain when improved. Stability is and can be trained, but it is also something innate. Panjabi published in 1992 a stability system which has since then been used in various studies and books (Norris 2008, 11; Waddell 2004, 160-161; Dieen & Kingman 2013, 42). The system divides stability into three subsystems including: passive, active and neural control (Dieen & Kingman 2013, 42).

4.1 Passive Stability

The passive stability system is the spinal column including all its tissue and ligamentous attachments (Waddell 2004, 160; Norris 2008, 11). This support implies that the individual does not have to think in order for this form of support to take place. Ligaments and facet joints are primary examples, as they provide support to keep the vertebrae in place, thereby limiting excessive motion without the individual needing to activate these structures (Norris 2008, 10).

4.2 Active Stability

The active stability system is conducted by "contractile tissues" (Norris 2008, 11), including "muscles and tendons" (Waddell 2004, 161). This system is one that often becomes the primary focus during rehabilitation (Norris 2008, 11). It provides more support for the passive system and reduces the risk of "excessive stress on the body tissues" which can be caused by a poor ergonomics (Norris 2008, 12).

Muscles can be grouped according to action, which allows the practitioner and client to understand how the muscle is designed to work and thus develop a better strengthening or rehabilitation program. Muscles may be grouped as "stabilizers" and "mobilizers" (Norris 2008, 61). Each muscle has a fiber type, fast or slow twitch. The "stabilizers" are slow-twitch. The contractions last for longer periods of time and increase progressively as needed (Norris 2008, 61-63). In comparison to its counter, fast-twitch fibers belong to the "mobilizers" muscles. These muscles are recruited for

immediate action, contracting rapidly for maximum effort but exhaust quickly (Norris 2008, 61; Waddell 2002, 163).

Muscle contraction applies pressure on the surrounding structures, providing the stability (McGill 2007, 118). Equilibrium of muscle contraction surrounding the structures is necessary to avoid faulty postures. Consider the transverse abdominis and multifidus, two muscles considered valuable contributors for low back stability (Kisner & Colby 2007, 387). The transverse is located in the front and the multifidus in the back. Simultaneous contraction of these muscles will provide equal support for the trunk. These muscles are reportedly the first to activate in a healthy individual (Kisner & Colby 2007, 387; Sahrmann 2002, 73; Waddell 2002, 163). Lack of or postponed activity of the transverse abdominis is common in those suffering from LPB (Kisner & Colby 2007, 390) which may lead to an improper muscle activation order, such as over-activation of the multifidus and thus placing added stress on passive structures in the trunk. In should be noted that during certain positions, continuous activation of certain muscles is not necessary. A fully flexed position while sitting allows for a stretch in the back (Nelson & Kokkonen 2014, 83), which would not be possible if the muscles in the back would not relax (Waddell 2002, 163).

4.3 Neural Stability

The Neural stability is controlled by the central nervous system (CNS). The CNS is responsible for sending sensory feedback regarding position and changing demands and providing direction for the active system (Norris 2008, 10; Waddell 2004, 161). CNS is able to adjust as needed and will use previous experiences to adjust the stability for new situations (Norris 2008, 58). As the task or environment changes, the CNS will continue to send signals to change stability accordingly and make modifications as needed (Norris 2008, 58).

All three systems are essential and need to be considered when focusing on stability. Despite each system having its own action process, if one of the three is disrupted, it will cause a chain reaction to the other systems (Waddell 2004, 161).

5 MOTOR CONTROL

Any task, whether it is picking up a glass, getting up from bed or completing a squat, requires the individual to have motor control, that is, the ability to complete a task independently by the means of one's own body (Shumway-Cook 2002, 1). Motor control can be learned, improved or hindered. There are three elements that affect one's movement: "the individual, the task and the environment" (Shumway-Cook 2002, 2).

Motor control is a rather complex system. The Central Nervous System (CNS) is highly involved in the process and numerous steps must take place accurately and at a rapid pace in order for the end result to be a fluent movement. When a certain task is demanded, the brain formulates and implements a plan of action (Shumway-Cook 2002, 51).

5.1 Motor Learning

Prior to having established motor control, the individual must first learn. Motor learning is "the complex set of internal processes that involves the relatively permanent acquisition and retention of a skilled movement or task through practice" (Kisner & Colby 2007, 24). Motor learning has three stages: cognitive, associate and autonomous (Kisner & Colby 2007, 27).

Cognitive stage is the first stage in which the individual is able to introduce self to the new task and learns the "what" and "how" (Kisner & Colby 2007, 27). Most mistakes take place during this stage. It is important that the individual understands when he makes a mistake and how to correct. Thorough verbal or written instruction will guide the individual to learn the task correctively and allow him to continue into the next stage. The associate stage allows the individual to fine tune the task. Mistakes lessen and confidence increases as the individual learns to manipulate the factors, such as speed. Once the individual is able to complete the new task automatically, he has reached the final stage: autonomous. The individual is now able to complete the task without assistance and can increase the difficulty, such as by imple-

menting another task simultaneously or adding changes in the environment (Kisner & Colby 2007, 27).

Potential influential factors on motor learning should be considered prior to beginning (Kisner & Colby 2007, 27). An individual will have difficulty entering the final or even second stage if he does not have the motivation. Motor learning requires and demands practice (Kisner & Colby 2007, 28). As some tasks require more practice than others, motivation of the individual may be tested beyond what one is used to. Support from friends or a health professional may be beneficial for those desiring to learn extensive tasks or skills. Other factors influencing the learning process include: how the task is taught, understanding of instruction, frequency and quality of practice or sensory and environmental feedback (Kisner & Colby 2007, 28).

5.2 Coordination

Executing movements in a "smooth, accurate and efficient" manner is the basis of coordination (Kisner & Colby 2007, 2). Learning a new task may require several attempts before developing a coordinated sequence. The CNS has a memory bank of past actions and uses them as references when encountering new tasks in order to prepare the body for action, such as contracting muscles (Norris 2008, 58). In this way, the body is able to provide an estimated amount of stability, which can then be altered as the movement pattern continues (Norris 2008, 58).

Coordination can be disrupted in various ways. According to Dr. Jim Buskirk, an individual's CNS can be the reason for having poor coordination, known as an "equilibrium and balance processing problem," hindrance to the process of planning and implementation (Today News 2013). Despite the problem within the CNS, it can be improved through appropriate training (Today News 2013). Another challenge is "dysfunction" of tissues, structures or movement (Waddell 2002, 164). The body is reliant on its counterparts therefore dysfunction in one area will cause a reaction. Poor coordination has been linked to LBP due to muscle wasting or weakening (Waddell 2002, 169; Taimela & Luoto 1999, 1674).

5.3 Balance

Balance, also referred to as "postural stability" allows one to change movements, maintain a set position and manage a position despite perturbations (Kloos & Heiss 2007, 254). Despite this link between balance and stability, the two are different. Stability focuses primarily on the body, whereas balance focuses on the body and the environment (Kloos & Heiss 2007, 251). There are three specific determinants of the outcome of balance, including: musculoskeletal system, nervous system and contextual effects (Kloos & Heiss 2007, 252). Combining all three factors together will determine how well balance may be sustained. The systems mentioned are similar to the active, passive and neural stability systems described earlier. The third determinant, "contextual effects" can be further explained as environmental influences, such as uneven surfaces, noise, small spaces and so forth (Kloos & Heiss 2007, 252).

Poor balance is a risk for or a result of LBP. Adults suffering from chronic LBP often have worsened balance, which consequently increases the risk of falls (Dieen & Kingma 2013, 51; Taimela & Luoto 1999, 1672). Often, falling once, specifically for elderly, increases the risk of falling again (Kloos & Heiss 2007, 259). Falling is frightening and may cause a dominating state of fear that can alter one's function (Waddell 2002, 171).

5.4 Reaction Time

Reaction time refers to the time in which it takes for the stimulus to cause a response (Kauranen 1999, 21). This stimulus may come by surprise, such as being bumped into, or it can be expected, being passed a ball.

Reaction time is initiated in the brain. It has been studied that initiation process in the brain is hindered in individuals with LBP. A theory by Luoto (1999) suggests that pain inhibits the short-term memory pathway in the brain causing a disruption in message signals (Taimela & Luoto 1999, 1672). If the pain is removed than technically the disruption should be no more (Taimela & Luoto 1999, 1672).

Delayed reaction time may also be the fault of delayed muscle activation. Slowed muscle reaction will hinder proper movement execution and thus affect motor control. It has been studied in individuals with LBP that muscles may develop delayed reactions, specifically the multifidus and transverse abdominis (Norris 2008, 45-46, 57). This proposes a problem for motor control. The multifidus and transverse abdominis are first muscles to be activated for stability and coordination of movements, therefore if the activation is slowed than the stability and coordination will be hindered (Waddell 2004, 163).

6 LOW BACK PAIN

The first documented report regarding back pain has been traced back to 1500 B.C showing that medical professionals have been struggling with this problem for quite some time (Waddell 2004, 47). Currently, LBP is a hot topic today, with google search engine delivering over 79 million results regarding this topic. Various organizations have been created solely dedicated to research regarding back pain, such as the Finnish Back Organization (Suomen selkäliitto). Unfortunately, despite all the information available, LBP is still one of the leading causes of disability (Kaplan, Wirtz, Mantel-Teeuwisse, Stolk, Duthey & Laing 2013, 165; Hoy, Brooks, Blyth & Buchbinder 2010, 770) and work-related health problems (Mwilila 2008. 1; Kaplan, Wirtz, Mantel-Teeuwisse, Stolk, Duthey & Laing 2013, 165). An estimated 85% of people will have a mild form of LBP at some point in their life (Moseley, Nicholas & Hodges 2004, 2339). LBP is a common problem throughout the world, primarily for adults and as of recent, for children and adolescents (Kaplan, Wirtz, Mantel-Teeuwisse, Stolk, Duthey & Laing 2013, 166).

6.1 Definition

Low back pain has been referred to as a symptom or group of symptoms (Gilcreest 1938, 988; Waddell 2004, 2; Kaplan, Wirtz, Mantel-Teeuwisse, Stolk, Duthey & Laing 2013, 166; Ehrlich 2003, 674), condition (Mwilila 2008. 1) or disorder

(Waddell 2004, 2). It appears difficult to find a consensus, despite the years of research.

LBP is vaguely described as "a local or referred pain at the base of the spine…" by Mosby's medical, nursing and allied health dictionary. Dividing the word in two will provide a more detailed definition. Low back is defined as the area "below the costal margin and above the inferior gluteal folds," (Barr 2009, 8) (figure 3) and pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Waddell 2004, 33).

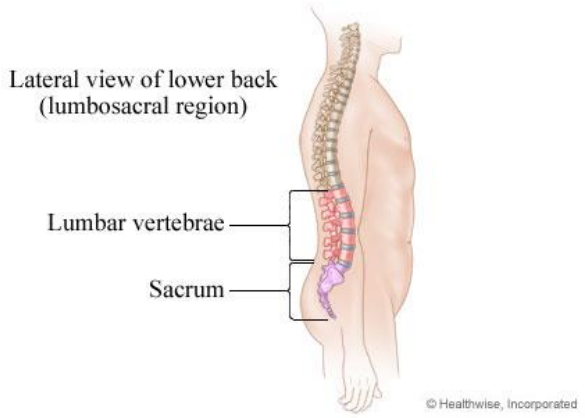

Figure 3. Spine and location of low back. Website of My Health Alberta.

6.2 LBP Classifications

There are three types of LBP: serious, radicular pain and non-specific (Luomajoki 2010, 3). Serious LBP is caused by trauma and radicular LBP by "nerve root irritation" (Luomajoki 2010, 3). These two are less commonly diagnosed. Non-specific LBP is currently the diagnosis of 85-95% of all LBP cases (Hoy, Brooks, Blyth & Buchbinder 2010, 775). It can be divided into three classifications: Acute, Subacute and Chronic (Waddell 2004, 35; Luomajoki 2010, 3). Acute and chronic are most common (Waddell 2004, 33) and therefore will be discussed in further detail.

Acute LBP is often easier to manage, as the symptoms usually match the test results (Waddell 2004, 33). Acute pain is often the result of tissue damage and is commonly associated with other symptoms, including increased heart rate (HR) or blood pressure (BP) (Waddell 2004, 34). The time period to which the acute classification is

applicable ranges from 0-6 weeks (Waddell 2004, 33; Bakker 2008, 11). Prognosis is frequently positive and improvement should be seen within 4 weeks (O'Sullivan, P. 2005, 242). Although, this does not indicate the individual will not experience LBP later on. Once an individual has had an episode of LBP it is likely to happen again (O'Sullivan 2005, 242).

Chronic LBP (CLBP) is the more complex classification. This brings about challenges not only to the individuals suffering from it but also the health practitioners trying to relieve it. Chronic is often diagnosed if low back pain has been continuous for 3 months or more (Waddell 2004, 35; Barr 2009, 14). This chronic diagnose makes up approximately 10-40% of all diagnosed LB disorders (O'Sullivan 2005, 242). Test results may not have any correlation with the LBP itself, adding further confusion in the treatment process (Waddell 2004, 33). Over time the CNS adapts to the continuous pain and causes chemical changes in the brain which may alter the individual's pain threshold, either by increasing or decreasing sensitivity (Waddell 2004, 28; Wand et al 2010, 3). The prognosis is poor if not managed. The longer the individual's LBP is classified as Chronic, the more complex the problem may become. Individuals with chronic LBP are more likely to have their working life disrupted and/or suffer disability (Luomajoki 2010, 2).

6.3 Risk Factors

Risk factors are many and vary according to the individual and his environment (Waddell 2004, 92). It appears challenging to find a consensus on which factors without a doubt propose a risk of developing LBP.

Personal factors, such as age, gender and weight can be considered risks for LBP. Working-aged adults and elderly are considered high-risk groups for LBP (Hoy, Brooks, Blyth & Buchbinder 2010, 776; Kaplan, Wirtz, Mantel-Teeuwisse, Stolk, Duthey & Laing 2013, 166). Prevalence is low among children but increases during adolescence, with chronic LBP appearing in adolescence as young as 14 years old (Luomajoki 2010, 3). Those who experience it once are very likely to have a reoccurrence (Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1636; June & Cho 2009

480; Barr 2009, 15). Women, reportedly, have a higher risk (McGill 2007, 33; Waddell 2004, 92) although, this may be due to the fact that women are considered more likely to seek medical advice (Waddell 2004, 95). Being over-weight or obese has also been considered a potential risk factor for LBP (Vieira, E.R., Kumar, S. & Narayan, Y. 2006, 148). However, personal risk factors are considered to have low reliability as studies do not report similar attributions of personal factors and their effect on LBP (Mitchell et al 2009, 679).

Psychological factors, such as "negative beliefs" or "catastrophizing" are considered potential high risks for LBP and CLBP (O'Sullivan 2005, 244; O'Sullivan 2011, 2; Mitchell et al 2009, 679). Stress and depression considered potential risks or predictors of LBP (O'Sullivan 2011, 1; Mwilila 2008, 9-10). Psychosocial risk factors are often caused by one's job and include job dissatisfaction and lack of support from coworkers (Mwilila 2008, 10).

Physical risk factors are numerous. One's job may propose a series of physical risks. Sitting too long or lifting too much are both considered risks (O'Sullivan 2005, 244). Falling is a risk, but this cannot necessarily be predicted ahead of time. There are a select few physical factors which appear to consistently propose risk of developing LBP or CLBP, specifically: static work postures, heavy lifting and continuous or excessive twisting or bending of the spine (O'Sullivan 2005, 244; Waddell 2004, 103-104; Barr 2009, 15). Along with these, other physical factors which are known to propose risk include: physical inactivity, disturbed motor control, low back muscle endurance, poor cardiovascular health, improper posture (Mitchell et al 2009, 679) and decreased functional capacity (Taimela & Luoto 1999, 1669).

Deciding which factors are and are not risks is a challenge amongst health practitioners. According to some studies, physical factors have higher risks than personal, psychological and psychosocial (Mitchell et al 2009, 679). Interestingly, O'Sullivan (2011) argues that current research is showing that cognitive, social and psychological factors play a higher role in LBP development than they are accredited with (O'Sullivan 2011, 1).

6.4 Causes

Causes of LBP are debatable. There are clear causes which can be proven through imaging and tests, whereas others through knowledge, assumption and behavioral evidence.

Back pain is often the result of a mechanical problem (Waddell 2004, 153; McGill 2007, 11). On occasion it may also be the result of pathology (Waddell 2004, 155; Castellani et al 2014. 211). The mechanical problem is caused by sudden trauma or an accumulation of loading over an extended period of time (McGill 2007, 14; Waddell 2004, 159) such as maintaining flexion for long duration or continuously lifting improperly. (McGill 2007, 124-125, 145). The end result is a structural change, such as vertebrae shift, muscle weakness or muscle tightness. Nerve endings, known as nociceptors, located in various structures, relay the information back to the brain resulting in the stimulation of pain (Waddell 2004, 154).

Along with mechanical causes, there are suggestions of "inorganic" causes (Norris 2008, 4) or non-structural, including: labels of disability, involvement of legal disputes delaying return to work, "perceived disability" or "anticipation of pain" (Norris 2008, 4). These nonorganic causes may entice the individual to prolong symptoms despite there being no physical problem. Whether or not inorganic causes are independent of structural change is questionable. Propositions have been made that it is not that pain is due to inorganic causes but rather an anatomical change has simply not been found via imaging or tests (McGill 2007, 26).

6.5 Pain and Illness behavior

Pain plays a major role in LBP, not only physically but psychological as well. Pain is subjective and often influenced by the individual's circumstances. An individual under emotional stress will have trouble recovering despite the quality of the care. Often depression, anxiety and other psychological symptoms are linked with chronic pain, either as risk factors or end results from prolonged suffering (Waddell 2004, 34; Website of In the Face of Pain; Hoy, Brooks, Blyth & Buchbinder 2010, 776).

"Pain behavior is a form of communication" (Waddell 2004, 29). Clients reveal how the pain affects them by communicating verbally or through actions, such as moaning or wincing (Waddell 2004, 29). The challenge behind pain behavior is the behavior may not necessarily match the test results, as individuals will react differently to pain (Waddell 2004, 28-29). Individual's with chronic LBP pain may give misleading pain behavior, as their pain threshold is often lower than healthy individuals, not only in the low back but in other parts of the body as well (Wand et al 2010, 3).

Similar to pain behavior is illness behavior, which "is what people say and do that expresses or communicates that they are ill…" (Waddell 2004, 179). This proposes a bigger challenge for health practitioners as it can lead to exaggeration of one's symptoms or catastrophizing (O'Sullivan 2011, 2). A consequence of exaggerated pain or illness behavior is fear-avoidance, that is, the avoidance of certain movements or activities fearing the result will be pain (Castellani et al 2014, 212). A continuation of fear-avoidance can interfere with treatment (Waddell 2004, 211).

6.6 Economic burden

Economically, LBP proves to be onerous for the government and the healthcare sector (Kaplan, Wirtz, Mantel-Teeuwisse, Stolk, Duthey & Laing 2013, 166). In the UK over 100 million workdays are lost each year and in the USA as many as 149 million (Kaplan, Wirtz, Mantel-Teeuwisse, Stolk, Duthey & Laing 2013, 166). With these days lost, the financial costs have reached exponential amounts. In Switzerland, LBP costs are estimated to exceed 7 billion euros each year (Luomajoki 2010, 2). In the USA over 100 billion dollars is lost due to LBP (Kaplan, Wirtz, Mantel-Teeuwisse, Stolk, Duthey & Laing 2013, 166) with 16 billion lost due specifically to "work-related back injuries" each year (Mwilila 2008. 14).

7 LOW BACK PAIN IN NURSING

Nurses are considered a high-risk group for the development of LBP (Kyung, J.J & Cho, S-H. 2009, 479; Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1637). A

study in Norway interviewed 4,266 nursing aids, 47.6% reported to suffer from low back pain within the past 3 months and of this group, 14% had been "intensely bothered" (Eriksen 2004, 400). Yearly prevalence rates for nurses vary from 41-76% (Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1637; June & Cho 2009, 480) with lifetime prevalence ranging from 56-90% (Maul, Läubli, Klipstein & Krueger 2003, 497). In Finland, sick-leave for nurses is most often due to non-specific LBP (Website of UKK-institute). Outside of the working population, LBP prevalence has also been reported amongst nursing students during theoretical studies or nurse training (Johnsson 2005, 3; Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1637).

LBP is not only a painful experience, but an emotional one. The impact of LBP affects the nurse's job and personal life (Mwilila 2008, 12). Early retirement (Website of UKK institute), feelings of social isolation, interruption of sexual activity and fear-avoidance are common outcomes, which may in turn cause LBP to become chronic (Mwilila 2008, 11-12).

LBP is a major problem, affecting nurses in all parts of the world (Mwilila 2008, 2). It is highly recommended to start prevention during the nursing studies (Mitchell, O'Sullivan, Burnett, Straker & Rudd 2008, 1636, 1642) and to educate already working nurses to lessen the likelihood of LBP development in the working life (June & Cho 2009, 485).

Risk factors for LBP in general were discussed earlier. Further risks of LBP, primarily in nursing will be discussed in detail, including: work demand, poor ergonomics and personal factors.

Nursing is a demanding job, physically and emotionally. Psychosocial factors in the work, such depression or stress, have been considered potential risks for nurses (Mwilila 2008, 9; Eriksen Bruusgaard & Knardalh 2004, 398; Maul, Läubli, Klipstein, & Krueger, 2003, 497). Poor support and job dissatisfaction have been associated to nurses with LBP (Mwilila 2008, 10). Although these links have been made between psychosocial factors and LBP, some researchers say there is inconclusive evidence compared to physical risk factors (Maul, Läubli, Klipstein, & Krueger 2003, 497). Physical risk factors are numerous and include: lifting, bending (Mitch-

ell, O'Sullivan, Burnett, Straker & Rudd 2008, 1642), patient handling and twisting/rotation (Eriksen, Bruusgaard, & Knardalh 2004, 398; Mwilila 2008, 9; Li, Wolf, & Evanoff 2004, 212). Studies have found also specific jobs or job demands which have directly linked to higher prevalence rates LBP including: working in ICU units (June & Cho 2009, 480) or nursing homes (Eriksen, Bruusgaard & Knardalh, 2004, 403), having 6 or more night shifts a month (June & Cho 2009, 485) and working as nursing aids (Li, Wolf, & Evanoff, 2004, 212).

Nurses are responsible for lifting and transferring patients on a daily basis. Often the task is not a simple shift or slide. There may be limited timing and limited resources of staff or aids, which adds stress to the situation. A nurse under stress and pressure may neglect her own ergonomics easily. One study concluded that inadequate staff was associated with higher back pain prevalence (June & Cho 2009, 484). A biomechanical study on spinal load showed that nurses often lift loads that exceed the maximal limit as proposed by the National Institute for Occupational Safety and Health (Johnsson 2005, 4). One affecting factor of the load depended on the technique nurses used. When the nurses followed ergonomic based transfer positions the load on the spine was proven significantly low in comparison (Johnsson 2005, 4). However, despite nurses being educated in ergonomics, these safe-techniques are not always used due to insufficient staff, forgetfulness, hazardous environment or loads being too heavy to maintain proper ergonomics (Mwilila 2008, 41).

The evidence regarding personal factors as risks for nursing in particular is debatable. Researchers argue that personal traits lack agreeable evidence regarding effect on LBP prevalence (Mitchell et al 2009, 679; Eriksen, Bruusgaard, & Knardalh 2004, 398). A report by the World Health Organization concluded that personal traits including obesity, lack of physical activity and smoking are "associated" with LBP (Woolf & Pfleger 2003, 652). Whether personal factors are risks or outcomes, they are often involved in LBP cases, and as such should be taken into consideration during treatment and prevention (Mwilila 2008, 10).

8 FUNCTIONAL TRAINING

"And of what use is their strength? Is it of use on the farm? Can the athlete dig, harvest, or accomplish more in agriculture...do we combat with the discus in hand? The enemy approaching, we recognize the foolishness of his preparation" - *Galenius, Claudius* (Silver & Morin 2008, 71).

Functional training has been around for centuries. In history, records tell of knights training by throwing heavy stones, wrestling and climbing over walls (Silver & Morin 2008, 71). The objective was to strengthen and condition the whole body in ways that mimic actions in battle. Functional training mimics real-life situations allowing the individual to develop clear goals.

There are a grand number of functional exercises and training interventions available. Functional training cannot be considered the best, but it can be considered a viable option.

8.1 Physical Activity Recommendations

Physical activity (PA) is considered a vital "biological stimulus" for the human body (Vuori, Lavie & Blair 2013, 1446) and participation in regular physical activity will "promote and maintain good health" (McArdle Katch, & Katch 2010, 476). PA is proven to have numerous benefits, including but not exclusive to: osteoporosis prevention, enhanced sleep, lowered HR, healthy body-weight maintenance and improved feelings of self and ability to manage stress and illnesses (Edlin & Golanty 2007, 155). Official PA recommendations in Finland for ages 18-64 is a combination of strength training and either moderate or vigorous aerobic activity every week (Website of UKK institute).

Individuals have a plethora of options of physical activities to choose from, including running, garden work, tennis, hiking, aerobics class, kettlebell training and so forth. It is suggested that individuals choose activities that interest them and match their goals (Edlin & Golanty 2007, 162).

8.2 Therapeutic Exercise

Therapeutic exercise includes a vast amount of exercise types, all with a similar purpose. Therapeutic exercise aims to prevent dysfunction, improve physical function and promote well-being (Kisner & Colby 2007, 2). This term is commonly used in physical therapy and rehabilitation. Some exercises may prove to be more effective than others, depending on the purpose, aims and condition of the individual. Relaxation exercises may be proven by a randomized control trial to be beneficial for LBP but this does not indicate it will benefit all individuals with LBP. Individuals differ despite having a similar diagnosis; therefore therapeutic exercises should be individualized (Kisner & Colby 2007, 2). Examples of intervention types currently in use are aerobic conditioning, balance exercises, relaxation exercises and functional training (Kisner & Colby 2007, 3). Choosing the appropriate type of therapeutic exercise is challenging. Therapeutic exercises may be implemented for individuals currently with a dysfunction/impairment or those seeking prevention of dysfunction/impairments (Kisner & Colby 2007, 2).

All types of therapeutic exercise focus on elements important for overall function of the individual (Kisner & Colby 2007, 2-3). According to Kisner and Colby, function consists of 6 elements: muscle performance, cardiopulmonary/endurance, balance/postural equilibrium, stability, neuromuscular control/coordination and mobility/flexibility (Kisner & Colby 2007, 2). Exercises should be chosen according to the needs and goals of the client (Kisner & Colby 2007, 3).

8.3 Benefits of Functional Training

Functional training is multi-dimensional. It allows the individual to learn how to use the body, develop stability and strengthen muscles. Functional training aims to "overcome specific musculoskeletal and chronic health problems" (Silver & Morin 2008, 85) through various types of activities or exercises that are transferable in the everyday life (Silver & Morin 2008, 73-74). Functional training may also be used recreationally, in training for sport or general fitness to improve performance (McArdle, Katch, & Katch 2010, 512; Cotter 2014, 3). Regardless of the goal, func-

tional exercises use the entire body rather than focusing on one specific muscle, limb or joint (Cotter 2014, 3). It allows the individual to have a "purpose for training" (Silver & Morin 2008, 73) and understand the value of the body as a unit rather than compartments (Cotter 2014, 3).

Individuals are able to see the direct outcome of their training in their lives, which could serve as a motivational factor. Functional training uses functional positions and movements, such as standing or walking, to enhance the applicability of the exercises to everyday life (Norris 2008, 167; Kisner & Colby 2007, 421). Exercises can also teach LBP clients how to use the back properly for daily living (Norris 2008, 283). Each activity should be exaggerated from the actual circumstance, by increasing intensity or repetition or changing the environment allowing for real-life situations to be more manageable (Silver & Morin 2008, 77, 85). Benefits of functional training have been studied for low back pain with positive results for adults (Silver & Morin 2008, 76; Töyrylä-Aapio 2010, 19).

9 KETTLEBELL

The first time kettlebell appeared in word form was in Russia in early 1700s by the name "girya" (Brooks 2012, 9; Cotter 2014, 3), since then it has come a long way. The kettlebell's popularity soared in Russia, as it was used to demonstrate great strength (Brooks 2012, 9; Cotter 2014, 3). The military began to use this innovation on their soldiers, specifically in their functional tests (Brooks 2012, 9). Each military system in the world has their own way of testing the physical and functional ability of their soldiers while they are in training, for Russia it was how well the individuals could perform tasks with the kettlebell. Leaders in the Russian army noticed how kettlebell exercises tested the individual's ability to use the body as a whole to complete certain exercises (Brooks 2012, 9). By 1985 a committee was created for Kettlebell Sport (Brooks 2012, 9). Since then the Kettlebell has spread throughout the world, arriving in the USA by early 2000 through the efforts of native Russian Pavel Tsatsouline, also known as "the modern King of Kettlebells" (Website of Kettlebell Science).

9.1 What is the Kettlebell?

The Kettlebell is an iron ball with a handle (Figure 4). Weight selection starts from 4 kilograms (kg). The shape is often the same, although differences can be seen according to the distribution company and training objective. Competition kettlebells are larger in comparison to fitness, although both kettlebells can be used for regular training purposes (Cotter 2014, 7). Other possible variations regarding the kettlebell shape include handle thickness and style among others (Cotter 2014, 11-12).

Figure 4. Two standard kettlebells used in lecture (see implementation)

9.2 Benefits Kettlebell Training

Kettlebell training is considered a form of functional training (Cotter 2014, 3; Kilpeläinen 2010, 14). This piece of equipment has a unique shape and weight distribution, which allows individuals to use it in ways mimicking activities of daily living (Cotter 2014, 2; Kilpeläinen 2010, 16). The weight distribution is below the hand in comparison to a dumbbell where the weight is distributed on either side of the hand. This unique feature allows the kettlebell to be used in "ballistic" movements, which are not possible to complete with the barbell or dumbbell (Cotter 2014, 2). The shape also permits the individual to hold the kettlebell in various supportive techniques, such as the rack position, which incorporates more muscle groups and prevents fatigue of the muscles needed for gripping the handle (Cotter 2014, 16).

The Kettlebell can be used in numerous ways targeting all major muscle groups through different series of lifts and swings (Cotter 2014, 4). Kettlebell exercises incorporate and train strength, power, dynamic flexibility (Brumitt, Gilpin, Brunette, &

Meira 2010, 258; Cotter 2014, 2) and arguably cardio-respiratory (Cotter 2014, 2). Other benefits include weight loss, increased muscle tone (Cotter 2014, 4), improved posture, coordination and balance (Nurmi 2012, 8) and injury prevention (Ayash & Jones 2010, 8). Kettlebell has also been in sports rehabilitation (Brumitt, Gilpin, Brunette, & Meira 2010, 264), therapeutic training (McGill 2009, 260) and improvement of musculoskeletal health (Jay et al 2011, 196).

The kettlebell's shape and weight distribution gives it a unique functionality. The kettlebell weight distribution in comparison to regular weights is an "unstable force" (Liebenson 2011, 542). This unstable force simulates loads similar to daily activities, such as carrying a grocery bag (Liebenson 2011, 542; Cotter 2014, 3). Its unique shape allows for specific movements such as the snatch and jerk to challenge one's flexibility and mobility as they incorporate the swing movement (Cotter 2014, 4).

The swing movement is considered the most popular and stereotypical kettlebell movement (McGill & Marshall 2012, 16-17). This movement trains the posterior chain and is considered an advanced "therapeutic extension exercise" (McGill 2009, 260). The individual develops strength in hip extension and learns to keep the back in a safe neutral position (McGill 2009, 260). This exercise has been used to improve musculoskeletal pain, including LBP (McGill & Marshall 2012, 16; Jay et al 2011, 200). Unfortunately, this exercise may propose a challenge for others. In a study by McGill and Marshall (2012), it showed that the kettlebell swing produces a posterior shear movement of L4 vertebrae as opposed to a normal lift, which causes an anterior shift (McGill & Marshall 2012, 26). This result gave way to a possible reasoning as to why the swing can be either painful or rehabilitating (McGill & Marshall 2012, 26). This movement has been included in various studies and is often taught in courses and books such as Steven Cotter's book "Kettlebell training." However, personal characteristics, such a physical ability and LBP history, need to be considered when pursuing movements that include the kettlebell swing, such as the snatch and bicep curl swing.

9.3 Guidelines for Kettlebell training

There are two forms of training, "functional fitness" and competitive (Cotter 2014, 7-8). For the purpose of this thesis primary focus will be placed on functional fitness.

Prior to beginning, the individual needs to consider his fitness level and plan the exercises and weight selection accordingly (Cotter 2014, 14). Recommendations for weight are available but weight variations differ for women, ranging from 4-12 kilograms (kg) and men 12-24 kg, depending on the reference (Nurmi 2012, 8; Cotter 2014, 15; Kilpeläinen 2010, 12). The challenge with kettlebell training is that the weight is set and cannot be modified like a barbell, however, this is also due to the fact that the goal of kettlebell training differs (Cotter 2014, 17).

Kettlebell training is often done in timed intervals (Cotter 2014, 21) therefore a stopwatch or timer is often recommended as an extra tool for training to be effective and accurate. The timed intervals include periods of work and recovery. The individual has the ability to adjust the time and session according to his goals and fitness level. Other methods of varying the workout include changing the speed of the exercise or training by repetition (Cotter 2014, 21).

For safety reasons, clothing should be chosen appropriately. Loose bottoms may hinder certain swing movements and therefore should be avoided. Shirts that are "slick" may infringe upon certain movements requiring friction (Cotter 2014, 21). Jewelry is not recommended, including rings, as this can hinder the grip (Kilpeläinen 2010, 18). Gloves are optional, however, not required. Shoes should be fitted and supportive; too much cushioning can hinder movement control and stability (Cotter 2014, 19).

Safety needs to be considered. Training should be done without distractions (Cotter 2014, 19). The kettlebell is swung during various movements and if the individual is easily distracted, this can cause a dangerous situation should the grip loosen and the kettlebell continue to move in the air. The individual needs to have sufficient space around him to perform movements as well, to avoid collisions of any kind (Kilpeläinen 2010, 18).

10 SELF-EFFICACY AND CHANGE

High self-efficacy is reported to be a valued motivational factor in the individual for change to take place (Blissmer, Hall & Marquez 2014, 359; Naidoo & Wills 2005, 20). Unfortunately, high self-efficacy although beneficial, is difficult to maintain with challenges the individual faces from himself and the environment. How then can a practitioner affect the individual's self-efficacy and how does this relate to learning kettlebell exercises? By understanding the theories of change and their value one can better learn how to encourage self-efficacy and how to promote healthy changes or habits, such as kettlebell training.

10.1 Self-efficacy

Self-efficacy is defined as "one's beliefs in their capability to successfully complete a course of action like exercise" by ACSM (Blissmer, Hall & Marquez 2014, 357). This belief of one's abilities will affect the overall outcome of goals one decides to pursue. Individuals with a high level of self-efficacy tend to be more positive and hard-working in comparison to those with low self-efficacy who are negative and may exaggerate the level of difficulty of new activities (Blissmer, Hall & Marquez 2014, 358-359). Having a high level of self-efficacy is stated in several theories as necessary in order to complete a change (Blissmer, Hall & Marquez 2014, 360; Naidoo & Wills 2005, 19).

In order for the individual to believe in one's abilities, he must find encouragement, which can be done in various ways. Practitioners should focus on providing various ways to build the confidence of the client, starting from the current level of the individual. There are various ways to build confidence, such as focusing on previous accomplishments or planning and implementing a simple task, which will in turn provide a feeling of confidence (Blissmer, Hall & Marquez 2014, 367).

10.2 Value of theories

Theories are defined as "organized sets of knowledge that help analyse, predict or explain a particular phenomenon" (Naidoo & Wills 2005, 19) Theories are present in everyday life. Healthcare theories are said to extract ideas from sociology and psychology, indicating the importance of the individual's social surrounding as well as own mindset (Naidoo & Wills 2005, 18). Currently, within the Healthcare sector there are arguments as to whether much time should be spent on theoretical learning, the "why" behind one's actions (Naidoo & Wills 2005, 15). Of course, some jobs are learned best from doing, however, when working with clients, should not the "why" be considered just as important? Theoretical learning gives "a common language…gives credibility to practice…make conscious decisions…provide explanations…a tool for logical and coherent practice" (Naidoo & Wills 2005. 16). The theory can be used as a tool for the practitioner. By understanding the various theories and concepts about the desired outcome or change, a practitioner is able to better formulate a plan according to the individual needs of the client and provide evidential answers. However, it should be considered that those seeking to make changes must understand the value behind self-efficacy, the individual's belief in his abilities (Naidoo & Wills 2005, 20). Self-efficacy is considered a major role in many theories and is a valuable component to change (Naidoo & Willis 2005, 20).

10.3 Theories of change

There are multiple theories currently available as formats for change with the majority focusing on the pros and cons of the change, self-efficacy and attitudes of others (Naidoo & Wills 2005. 20). Practitioners and individuals should educate themselves and decide which theory matches the current needs. Each theory brings similar ideas but some have different primary focuses. The author has chosen the following theories as possible options regarding promotion of kettlebell training for the nursing student.

The Transtheoretical Model by Prochaska and DiClemente is often used regarding promotion of exercise (Blissmer, Hall & Marquez 2014, 360). This model allows for

the individual to "relapse" and still have the opportunity to change (Blissmer, Hall, & Marquez 2014, 360). This model explains that change does not simply take place overnight, but rather following months of work can one reach the final stage, maintenance (Blissmer, Hall & Marquez 2014, 360). The model is subdivided into 5 categories in total: precontemplation, contemplation, preparation, action and maintenance. This model places emphasis on self-efficacy as well and its importance in developing along the different stages (Blissmer, Hall & Marquez 2014, 360).

The Health Belief Model by Becker focuses on an "individual's beliefs about whether or not he is susceptible to disease, and her perceptions of the benefits of trying to avoid it influence his readiness to act" (Blissmer, Hall & Marquez 2014, 362). This model focuses on six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy (Blissmer, Hall & Marquez 2014, 362). This model has been used for primarily physical activity promotion (Blissmer, Hall & Marquez 2014, 363).

Finally, there are various social ecological models that place focus on the effect of the environment on the individual (Blissmer, Hall & Marquez 2014, 365). These theories are necessary as they draw attention to the many factors which affect change including but not limited to: the individual motivation, education, family, culture, availability, and workplace (Blissmer, Hall & Marquez 2014, 366). Some environmental factors are adjustable while others are not (Blissmer, Hall & Marquez 2014, 366).

11 IMPLEMENTATION

A one-hour session was planned and organized. First year nursing students from Satakunta University of Applied Sciences signed up voluntarily for the session, which was held at Porihalli gym in Pori, Finland. Of the 25 students that informed interest 8 attended: 2 were absent due to sickness, 2 had a lecture planned around the same time and the remainder did not provide reasoning nor get in contact. Students signed a form of consent (see Appendix 2) allowing their pictures to be taken and published

in this thesis before the session began. A photographer was present to record the whole session.

The session began with a 20-minute lecture focusing on information in the exercise package regarding LBP and kettlebell training. The lecture was done in a casual manner to allow clients to feel relaxed, as this was only the second time meeting the instructor. The practical portion was 40 minutes and consisted of four parts: warm-up, practice round, workout demo and stretching. The warm-up was done without weights and lasted for approximately 8 minutes. The practice round focused on the movements in the exercise package. The exercises were shown one at a time with verbal instruction. The clients then practiced each movement for 2-3 minutes while the instructor provided verbal and manual feedback (picture 1 and 2). More time was given if needed. A demo round followed in which clients completed exercises independently (picture 3). Each exercise was done for 45 seconds back to back. The instructor provided verbal and visual guidance but refrained from manual guidance unless safety was compromised. The practical portion concluded with stretching that lasted approximately 4 minutes. All participants received a booklet (see Appendix 3) that included: information discussed in the lecture, information about the kettlebell and the kettlebell workout implemented with illustrations and written instructions.

Picture 1. Instructor providing verbal guidance during practice round.

Picture 2. Instructor providing manual guidance during practice round.

Picture 3. Clients completing exercise independently during demo.

Participants had the opportunity to provide information and feedback through a questionnaire following the session (see Appendix 1). This questionnaire was designed to inform the author what the client's background and knowledge regarding LBP and the kettlebell prior to the session and how the session impacted them. Of the 8 clients, 7 had experienced low back pain. Of these clients, 2 thought it was due to static postures, 3 due to weak muscles and/or lack of physical activity and 2 reported other.

All students said the session was educational. Regarding Kettlebell training, 7 out of 8 students would consider starting kettlebell training independently. The open feedback was positive. Clients felt the lecture was both motivating and educational.

As a thank-you, all clients received a three day pass to Porihalli Gym. This pass allows them to participate in group classes, such as Kettlebell and use the gym facilities free of charge.

12 THESIS PROCESS

The thesis process began in October 2013 and ended on October 16th, 2014 (Figure 5). There have been numerous cancellations and delays throughout the process, some factors were beyond control where as others were due to error. The estimated graduation date had to be deferred twice in order to ensure the quality of the thesis and the exercise package would not be negatively affected.

October 2013	Researching topic relating to child volleyball
October 2013	Topic plan cancelled
November 2013	New topic chosen
November 2013	Researching topic
December 2013	Finding theory and deciding objective
January-February 2014	Theory
March-.April 2014	Theory of LBP and lecture planned but moved to further date due to change in implementation. Agreement with nursing degree program made
May 10th 2014	Organizing Lecture and kettlebell class
May 2014	Lecture for nurses cancels, changes to theory
May-June 2014	Research
August 2014	Research and writing

September 2014	Writing; planning lecture for nursing students
October 2nd 2014	Lecture for nursing students held, feedback gathered, information added to thesis
October 3rd-October 13th, 2014	Final modifications
October 16th, 2014	Present final thesis

Figure 5. Schedule of thesis process according to author.

13 DISCUSSION

There have been several unexpected cancellations and challenges since the very beginning of the thesis process. Choosing a topic of interest, organizing the lecture and finding reliable and sufficient evidence caused this process to be deferred numerous times.

Exercise and fitness have been subjects of interest from the beginning however, I was unsure about a specific topic. I had two attempted topics prior to this thesis. The first topic of interest focused on weight management, this was however, cancelled due to situations beyond my control. I later came across another topic that focused on sport as I had requested, but the project itself did not interest me. It was very challenging and demanding trying to research a topic I had little interest in. I decided to cancel this topic as I knew my motivation would be lacking for this project and it would be unfair for the organization of interest. I began to consider what am I interested in and how can I connect it to physiotherapy. The result was Kettlebell training. I have been instructing kettlebell for almost 1.5 years and my own passion had been continuously growing. I believed this topic would keep me motivated and interested throughout the writing process. Together with my tutor and the help of my peers, my topic "Low Back Pain prevention for nursing students: A Kettlebell Intervention" was formed in November 2013. Following further discussion with my tutor it was decided that with my thesis I will create an exercise package and host a lecture based off of the package for nursing students. The lecture would be a way to test the quality

of the package. The lecture was originally supposed to take place in March 2014 for the first year nursing students. Students were contacted through email and only one responded. During my clinical placement I considered changing my topic for working nurses at a local hospital. Nurses had expressed verbal interest in the lecture however, when a deadline was set for written confirmation of attendance, no one responded. I decided to contact the nursing students at the SAMK again and change my focus back to its original, nursing students. I emailed first year nursing students and 5 responded. The lecture was set for April 2014 and I started to prepare. However, as I began preparing, it was evident that large quantities of theory were missing. I had focused so much on the gaining an audience that my theoretical portion had become disorganized. The lecture was postponed for fall 2014. The students were informed about the cancellation and received a three-day pass to the Porihalli gym. In early fall 2014, theoretical information had been sufficiently gathered and the exercise package was being finalized. I contacted the head of the SAMK nursing department in my final attempt to gain an audience. I was able to present a 5 minute presentation for first year nursing students regarding my thesis and the purpose of my kettlebell lecture, as a result 23 students signed up. Of 23 that informed interest, 8 attended, 2 were sick, 2 had classes and others did not get in contact. The kettlebell lecture was successful. Students gave positive feedback and the exercise package was deemed useful. Despite the process being stressful, the end result was made it worthwhile. Students who attended were motivated and very active, providing me further motivation to develop this thesis.

Finding reliable evidence of kettlebell training proved more challenging than expected. Although the kettlebell has been in use for hundreds of years, there is little reliable research done about it. Despite having personal experience, facts are needed to provide reliability. Many scientific articles regarding kettlebell were written in prestigious journal articles that I could not access. Other free articles I came across were often written by independent authors, who provided no reliable references for their explanations. Fortunately, I was able to find several theses' that had been written regarding the kettlebell that provided useful and accessible references as well as books recently published.

It was my goal that this paper would provide readers sufficient proof regarding the impact of LBP for nurses to raise awareness. LBP is a broad topic. It seemed to be endless tunnel of information and many times resources contradicted each other. Finding conclusive points was challenging and at times seemed impossible. LBP is indeed a world-wide problem, however, depending on the country, its impact varies dramatically. Considering my target group was nursing students in SAMK, I thought it was essential to have some information regarding LBP and its effects on Finnish nurses. Unfortunately, the majority of research and theory I came across was from USA, Canada, Australia and United Kingdom. Although my sources are not directly from Finland, they are still applicable as nurses have similar tasks and risk factors regardless of the location.

I would have been interested myself in testing the package on a nursing group to check the reliability, unfortunately due to time constraints and continuous changing of plans this was not possible. In the future, this exercise package could be tested on a group of Finnish nursing students who have had LBP during clinical placement, in order to see if the exercise prescription in the package is sufficient. Should the outcome measures decrease LBP prevalence or reoccurrence, it would enhance the reliability of the package as a form of prevention. If the outcome measures prove negative, then adjustments and enhancements can be made to the package as needed.

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APPENDIX 1

Kyselylomake
Questionnaire

1. Ikä
   Age
   a. 18–20
   b. 21–23
   c. 24–26
   d. 27–29
   e. 30+

2. Sukupuoli
   Gender
   a. Nainen
      female
   b. Mies
      male

3. Minkä vuosikurssin opiskelija?
   What study year are you currently in?
   a. 1
   b. 2
   c. 3
   d. 4

4. Harrastatko liikunta?
   Do you exercise?
   a. Kyllä
      yes
   b. Ei
      no
      i. Jos vastasit ”Kyllä”. Kuinka monta kertaa viikossa?
         If you answered yes, how many times per week?
         1. 1 kertaa 1 time
         2. 2-3 kertaa
         3. 4-5 kertaa
         4. 6+
      ii. Jos vastasit ”Ei”. Miksi?
         If you answered no, why not?

1. En pidä liikunnasta
   I do not like exercise
2. Minulla ei ole aikaa
   I do not have time
3. En uskalla (esim. huono itsetunto, huonoja kokemuksia)
   I'm afraid (ex. too self-conscious, bad experiences)
4. Rahallisesti minulla ei ole varaa
   Financially, I can't afford it
5. En tiedä mitä voisi tehdä ja miten pitäisi aloittaa
   I don't know what to do and how to start
6. Muu? -

   _____

   Other?

5. Onko sinulla ollut alaselkäkipua?
   Have you had Low back pain?
   a. Kyllä
      Yes
   b. Ei
      No
      i. Jos vastasit "Kyllä", mikä sinun mielestäsi on aiheuttanut sen?
         If you answered yes, what do you think has caused it?
         1. Sairaanhoitotyö esim. huonoja asentoja, asiakkaiden siirtäminen Nursing work ex. poor work postures, patient transfers
         2. Istuminen pitkiä aikoja esim. koulussa, autossa
            Sitting for a long time ex. at school, in the car
         3. Heikot lihakset
            Muscle weakness
         4. Liian vähäinen liikunta, mistä seuraa esim. huono selkä, tasapaino, vartalo hallinta
            Too little exercise which has caused ex. bad back, balance, body awareness
         5. Muu?

            _____

            Other?

6. Onko sinulla parempi käsitystä luennon jälkeen alaselänkivusta ja miten sitä voi hoitaa/estää?

Do you have a better idea about LBP and how to manage/prevent it?

a. Kyllä
   Yes
b. Ei
   No

7. Olitko kuullut kahvakuulasta ennen tätä opintonäytetyötä?
   Had you heard about kettlebell before this thesis?
   a. Kyllä
      Yes
   b. Ei
      No

8. Olitko käyttänyt kahvakuula tätä luentoa aikaisemmin?
   Have you used a kettlebell before this lecture?
   a. Kyllä
      Yes
   b. Ei
      No

9. Tuntuuko sinusta siltä, että voisit käyttää kahvakuulaa itsenäisesti tämän luennon jälkeen?
   Do you believe that you could now use the kettlebell independently following this lecture?
   a. Kyllä
      Yes
   b. Ei
      No

10. Oletko kiinnostunut aloittamaan kahvakuulailun tämän luennon jälkeen?
    Are you interested in beginning kettlebell training after this lecture?
    a. Kyllä
       Yes
    b. Ei
       No

11. Mitä palautetta haluat antaa lisäksi? Mitä voisi parantaa? Mistä pidit? Mitä olisit halunnut lisää? ☺
    What feedback would you like to give? What could be improved? What did you like? What would you have wanted?

APPENDIX 2

Satakunnan ammattikorkeakoulu
Satakunta University of Applied Sciences

PERMISSION TO USE PICTURES

I _____ (circle one) give / do not give permission to physiotherapy student GABRIELLA ELISA PELTONIEMI to use photos of me for her Bachelor's thesis as part of the English Degree Program of Physiotherapy at Satakunta University of Applied Sciences. I understand that the photos will be published with the thesis and will be available to the public.

Signature of individual providing consent

_____

Date and Place

_____

Kettlebell Exercise for Low Back Pain Prevention

An Exercise Package

Gabriella Peltoniemi
Satakunta University of Applied Sciences
English Degree Program of Physiotherapy
Part of Bachelor's Thesis

Gabriella Peltoniemi

Table of Contents

Purpose of this Package

The purpose of this package is to educate and motivate nursing students to take action in the prevention of low back pain. Low back pain (LBP) is a worldwide musculoskeletal problem causing economic turmoil as well as physical and emotional distress. Occupations involving manual labor, such as lifting and carrying heavy loads, are considered high risk occupations for LBP. Currently many studies show that nursing is one of the highest high risk occupations, with many nurses having sick-leave several times during the year or having to quit their jobs due to recurrent LBP. Those who experience LBP are twice as likely to experience it again later on, therefore early prevention is necessary.

This package briefly addresses LBP including epidemiological data and risk factors for nurses.

Functional exercises have been highlighted in research as a successful method for treatment and prevention. Functional exercises aim to strengthen muscles, improve stability and train motor control for activities of daily living, rehabilitation purposes or to improve sport-related skills.

This package aims to introduce the kettlebell as a form of functional exercise and includes a kettlebell workout focusing on the aims of functional training.

Gabriella Peltoniemi

Low back pain and nursing

General Risks Factors

- Female
- Physical fitness
- Smoking
- Education, Knowledge of ergonomics
- Emotional distress, Job satisfaction
- Manual handling, heavy lifting, flexed position while lifting, twisting, static work, sitting for extended time period

A study in Norway interviewed 4,266 nursing aids, 47.6% reported to suffer from low back pain due to the workload (Eriksen 2004, 400).

Additional risks for nurses

- Lack of staff
- Lifting heavier loads than recommended by national institute for occupational safety and health
- Night shifts 6+ per month
- Working in emergency Units

Mechanical problem

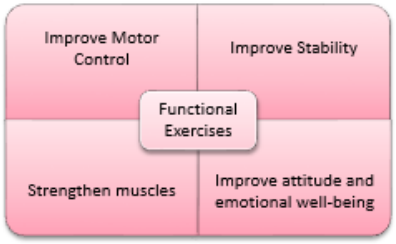
- Caused by sudden trauma or progressive overloading including: twisting, maintaining flexion for long duration, disturbed motor control, improper lifting and pushing
- May also be linked with other illnesses

69.9% of nurses reported LBP was pt. related and 55.6% reported standing with trunk flexed (Mwilila, M.C. 2008, 38-39)

Outcome of LBP

- Pain, fear-avoidance
- Depression, anxiety, feeling of seclusion
- Issues in personal life (relationships, sexual activity)
- Quitting job early

PREVENTION IS VITAL!



Kettlebell workout

- Workout main aims
  - Develop core stability
  - Develop motor control
  - Strengthen the legs
  - Improve endurance.
- Recommended starting weight
  - Females: 8 kg
  - Males: 12 kg
- Precaution
  - Not all exercises are suitable for all individuals
  - Exercises causing pain or discomfort should be avoided
  - Ensure proper hydration prior to exercising
  - Warm-up MUST be done prior to exercises
  - Stretches are HIGHLY recommended following exercises
  - Avoid distractions
  - Ensure environment is spacious to avoid collision

Warm-up

Approximately 5-10 minutes depending on length and intensity of workout.

Step 1: Begin with light cardio, such as cycling, jogging, jumping jacks etc. Focus on trying to increase the heart rate and get the blood circulating through the whole body.

Step 2: Continue with dynamic stretching of the arms, legs and trunk. Including: arm circles, leg swings, hip rotations and so forth.

Exercises

The exercises should be done in back-to-back. Each exercise is done continuously for 45 seconds. Recover for 1 minute. Repeat this sequence 2-3 more times. If short on time, do half of the exercises.

Kettlebell deadlift

Step 1: Place the Kettlebell on the floor in front of you. Stand with legs shoulder width.

Step 2: Brace the abs. Tilt from the hips and bring the butt back and down while maintaining a neutral spine and grab the kettlebell handle with both hands.

Step 3: Lift the chest slightly. Brace the abs.

Step 4: Push the feet into the ground, bring the hips forward and stand up.

Step 5: Return to start

Do not allow the back to round

Do not allow the knees to go over the toes

Keep the feet flat on the floor at **all** times

Maintain a tight core to keep the back in neutral position

Goblet squat

Do not allow the heels to lift from the floor

Tilt forward slightly from the hips

Maintain a tight core to keep the back in neutral position

Step 1. Stand with feet hip width apart. Hold the kettlebell bottoms up style.

Step 2. Brace the abs. Bring the butt down and back until knees are at a 90 degree angle.

Step 3. Dig the heels into the ground and return to start

Bottoms-up carry

Step 1: Hold the kettlebell by the handle on one side. Legs hip width apart.

Step 2: Brace the abs. Bring the kettlebell up into the bottoms-up position. Keep the elbow close to the body.

Step 3: Look forward. Begin walking while keeping the kettlebell in place. Repeat with other side.

Stay upright! **Do not** lean

Walk at a normal pace

Ensure the arm and kettlebell remain in the same position throughout

Figure-8

Step 1. Stand with feet wider than shoulder width. Hold the kettlebell with both hands.

Step 2. Brace the core. Squat down but keep the butt above knee height. Maintain a neutral spine.

Step 3. Weave the kettlebell through the legs creating a figure 8. Be sure to go in both directions.

Do not allow the heels to lift from the floor

Tilt slightly forward from the hips.

Do not allow back to round

Maintain a tight core

One-leg deadlift

Maintain a tight core

Ensure that the same side leg and arm are moving

Maintain a straight line from your head to your toes

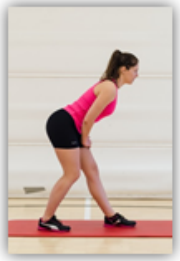
Step 1: Hold the kettlebell by the handle on the right side. Shift weight onto the left leg.

Step 2: Brace the abs. Keeping the neck in line with the back tip forward from the hips, bringing the kettlebell towards the floor while simultaneously lifting the back leg.

Step 3: Squeeze the butt and return slowly back to start

Stretches

Do the stretches in a relaxed manner, holding each stretch for 30 seconds. Repeat each stretch twice. If short on time, do once.



Hamstring

- Place the stretching leg in front. Lean forward from the hips toward the leg.
- Keep the back straight.
- A stretch should be felt in the back of the thigh. Switch sides.

Hip Flexor

- Bring the left leg in front and right leg back and lower it to the floor.
- Lean forward. The left knee should be above the ankle. Stretch should be felt on the right side in the hip region and front thigh.
- To stretch further, lift the right arm beside the ear. Switch sides.

Gluteus Maximus (Buttocks)

- Place the feet on the floor. Lift the left leg onto the right knee so the left ankle is above the right leg's kneecap.
- Place the hands behind the knee joint and pull towards the chest. Stretch should be felt in the left butt. Switch sides.

Low Back Release

- Place the knees flat on the floor.
- Place the hands on the knees and gently pull towards chest allowing the lower back to round. Repeat

Stay Motivated

✓Remember to have rest days

✓Consider other healthy lifestyle changes to combine with exercise

✓Reward yourself along the way

✓Results take time, but do not give up

Exercise for your career, your future and yourself!

http://arthlete.tumblr.com/

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