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The Effects of Weight Training on Women

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ABSTRACT

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Majority of modern women participate in sports and physical activity in one or another form. Common misconceptions and beliefs act as a barrier for females to engage in one of the most beneficial training styles, namely weight training. This thesis provides scientifically approved information regarding the effects of weight training on the female body. Commissioning party for the thesis is Myötätuuli. Target group for this work are the female clients of the commissioning party. The aim is to educate the target group in regards to weight training and motivate them to engage in it safely with the help of exercise technique videos and PowerPoint presentations.

The theoretical framework of the thesis report discusses the functional units of the skeletal muscle as well as the neuromuscular and hormonal responses which are evident in the female body due to weight training in short term and long term. Important matters regarding safety, recovery from training and sleep are also covered. The product which is developed for the commissioning party includes 10 exercise technique videos which cover the most basic and common exercises in weight training as well as three educational Power Point presentations which cover the theoretical information included in the thesis report.

The thesis process started after signing a commissioning agreement with Myötätuuli in October 2017 and finished in April 2018.

FORWARD

I would like to thank my thesis supervisor Olavi Pajala for the help and guidance I received from him during the whole project. I would also like to thank my family, friends and partner for supporting me during the time of implementation of this work.

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1 INTRODUCTION

Nowadays there are many different options for women to do sports and be physically active. Being one of them weight training is popular amongst professional athletes but not amongst the average gym goers. The benefits of weight training on women have been examined and proven in the past and yet we see many females who refuse to incorporate weight training and choose to focus on aerobic activities instead. One common barrier for women to engage in weight training is the fear of becoming too muscular. Positive effects such as stress relief and health enhancement are less thought of despite professionals saying that weight training should be part of balanced and healthy lifestyle.

This work is a research based product development thesis that aims to provide the reader with scientific knowledge focusing on the topic of women in weight training and more specifically, the effects of weight training on the female body.

The author of this work chose the topic as such to benefit her working life as a personal trainer and to expand her knowledge of this topic as it is one of primary interest for her.

Commissioning party for the thesis is Myötätuuli Learning Clinic. The party has many female clients who use the two gyms on the campus area of Kajaani University. Many of those females lack proper technique and knowledge regarding weight training and would benefit if someone prepares for them quality information regarding the essence of weight training, is it good for them and how to do it correctly to avoid injury and rip the health benefits of the exercise. The product that Myötätuuli will receive as a result of the research is technique instruction videos for its clients to use when training, together with three PowerPoint lecture materials covering the findings of the research which will also be available for clients to look at. The purpose of the thesis report is to present the scientific and quality information behind the presentations and videos to the reader.

2 MUSCLE AND MUSCLE'S RESPONSE TO TRAINING

In order for our hearts to beat, for the food which we have consumed to move through our intestines or for our bodies to move we need our muscles. There are three types of muscle tissue in the human body (Costill, 1994). One type of muscle tissue is the smooth muscle, which is found in the blood vessels and organs from the digestive tract such as esophagus, stomach or intestines. It enables them to contract or relax and thus moving the food and aiding digestion. Smooth muscle is not under voluntary control. It is controlled by the Autonomic nervous system. Other type of muscle tissue is the cardiac muscle which is found only in the human heart. Similar to the smooth muscle it is not under voluntary control. It pumps blood thought our bodies and is also controlled by the autonomic nervous system (Kostov, 2016). For example, when we are running it starts without our control to pump blood faster to meet the oxygen demands of the body and when we sleep it beets at a lower rate.

The third type of muscle tissue and the one that will be further discussed here is the skeletal muscle. This type of muscle is contractile and it is under voluntary control. It makes up between 30 and 50 percent of the human's weight (Moal & Pialoux, 2016). Skeletal muscles are responsible for activities such as breathing, talking and every physical move that we make.

2.1 Skeletal muscle anatomy

Even though each skeletal muscle acts as a single unit inside they are quite complex. (Figure 1) (Wilmore & Costill, 1994, p.27). Every muscle is surrounded by connective tissue called epimysium. If looked deeper under the epimysium there will be seen many tufts of muscle cells which are surrounded by connective

tissue which is called perimysium. Every perimysium surrounds a number of muscle cells called fibers. Muscle fibers range in size and depend on the function of the muscle. Most of them go through the whole length of the muscle meaning that even invisible with naked eye they might be more than 20 or 30 centimeters long. Muscle fibers are principally divided in two groups. Type 1 muscle fibers, also called slow twitch, are mainly involved in activities requiring muscle endurance. Type 2 muscle fibers, or fast twitch, are primarily used in physical activities which require speed, strength or power. Every person has individual ratio of these types of fiber. People with higher ratio of type 2 to type 1 muscle fibers perform better on all-out events such as sprints or powerlifting and people who have a higher ratio of type 1 to type 2 perform better on endurance activities. There is a gender difference in the ratio of the two types of fibers as studies on untrained men and women show. Approximately 75 % of women have larger slow twitch fibers than they have fast twitch whereas men have higher ratio of fast twitch to slow twitch muscle fibers (Zatsiorsky & Kraemer, 2006).

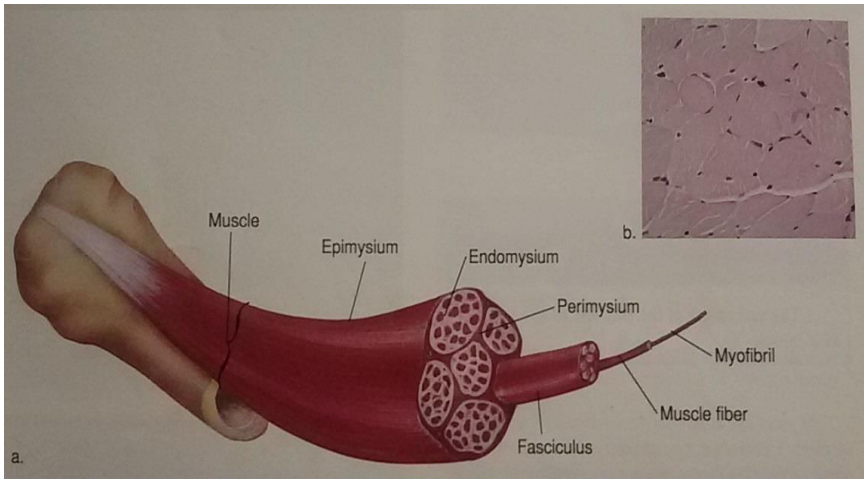

Figure 1. (a) Structure of the skeletal muscle and (b) a photo micrograph of a cross-section of skeletal muscle.

Wilmore, Costill & Kenney have discussed in their Physiology of sport and exercise (4th ed.) the building parts of the muscle fibre. Each muscle fibre is formed

from smaller units called myofibrils which vary from several hundred to several thousand in each muscle cell. If we look inside the myofibrils we will see the smallest building unit of a skeletal muscle – the sarcomere. (Figure 2) (Wilmore & Costill, 1994, p.29). Two types of structure make up the sarcomere – thick and thin filament. The thick filament is made up of protein called myosin and the thin filament is made up of protein called actin. In order for a muscle contraction to happen myosin heads bind to the actin and pull it towards the center of the sarcomere causing it to shorten. (Figure 3) (Wilmore & Costill, 1994, p.32).

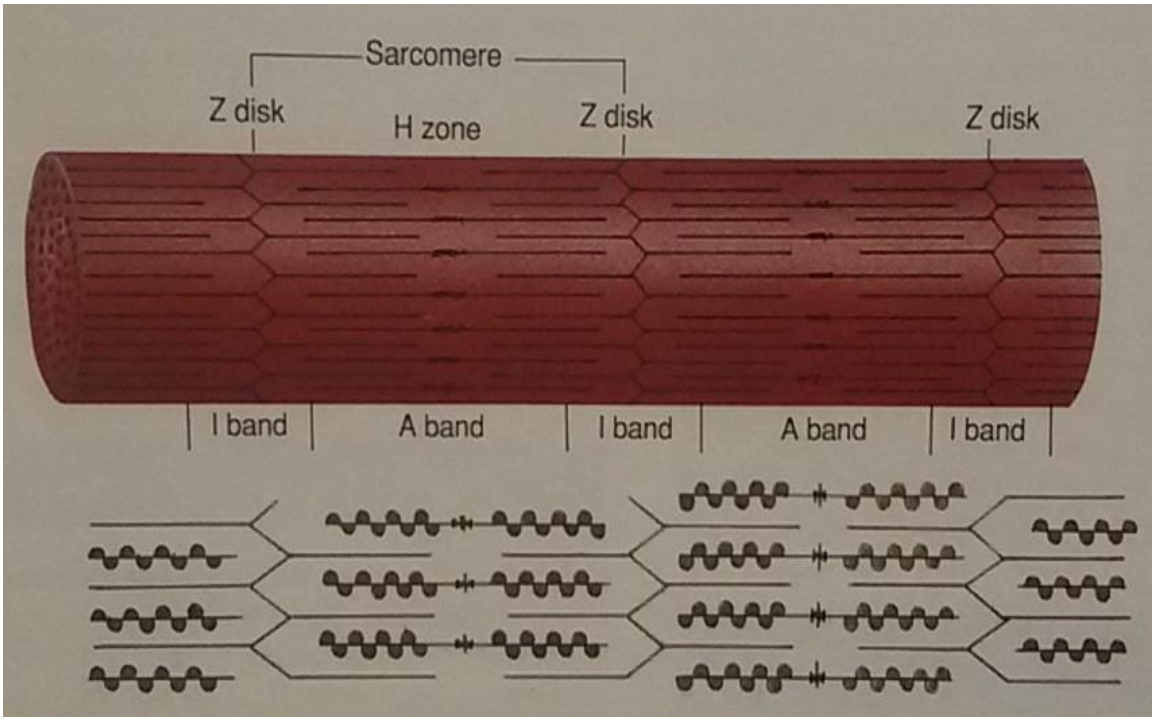

Figure 2. The smallest functional unit of the skeletal muscle – the sarcomere, is made up of thick and thin filament. Sarcomeres are connected to each other by Z disk.

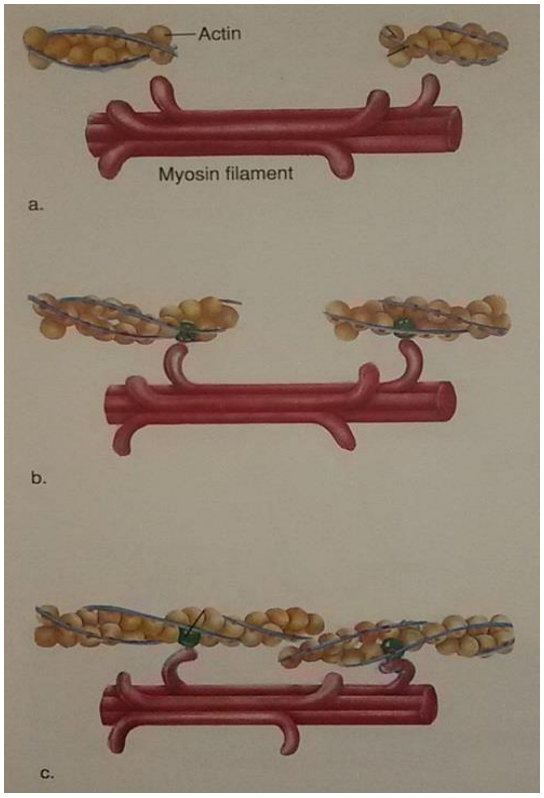

Figure 3. Actin (thin filament) and myosin (thick filament)

(a) Image of the units in relaxed muscle fiber

(b) Image of the units in contracting muscle fiber

(c) Image of the units in fully contracted muscle fiber

2.2 Neuromuscular connection

Of course, for a muscle contraction to occur there is the need for the brain to "command" it to the muscles. Every muscle fiber is connected to a motor nerve. One motor nerve together with all the muscle cells that it supplies is named a motor unit (Wilmore & Costill, 1994). When a nerve impulse arrives from the brain at the motor nerve ending, the motor nerve releases a chemical substance called acetylcholine which transmits electrical charge throughout the length of the whole fiber causing it to contract. In other words, the nervous system uses motor nerves that convey messages from the brain to the muscles. When a person first starts to perform certain exercises the motor nerve connections are weak. After some time of training, they become more efficient in transmitting

messages because the body adapts to the exercise (Bompa & Buzzichelli, 2015).

Resistance training and especially strength training is proven to be good for promoting maximal neural adaptation. In the early stages of the training sufficient neural adaptation can be obtained with low volume resistance training (Cannon & Marino, 2010). While studies show that gains in strength from weight training are apparent in both men and women rather equally, women experience less muscle growth than men. This is so because females have lower levels of testosterone (the primary anabolic and sex hormone in men) circulating in their bodies than males do. Testosterone helps men to grow lean muscle mass faster than women. This means that strength gains in women are present due more to the strengthening of the neuromuscular connections over time than to hypertrophy. Studies on women show that gains in strength are complex. One study examined the effects of progressive weight training program on 26 men and 47 women. Over the course of 10 weeks the women experienced an average increase of 29 % in bench press strength compared to only 17 % increase in strength which men experienced. The women also gained 30 % increase in leg press strength compared to 26% in men (Wilmore, 1974). Enoka (1988) has argued that gains in strength can be present without changes in the structure of the muscle but not without neuromuscular adaptations. Adaptations occur if the training load exceeds the load that has been previously used (Kraemer, 2006). These adaptations include better movement coordination and learning and better activation of the muscles which are being trained. This means that strength is not dependent solely on the size of the muscle. It is rather more dependent on the motor units and their recruitment. However, if research shows that in the early stages of resistance training increase in strength results to a great extend from neuromuscular adaptations, long term gains in strength are linked to hypertrophy (Sale & D.G., 1988).

2.3 Tendons', muscles' and bones' response to weight training

As previously mentioned, muscles and nerves experience adaptations to chronic weight training. The growth of the muscle size over time which results from training is called hypertrophy. A protein breakdown occurs in the muscles during training. In the followed resting period proteins are synthesized in the muscles to recover and rebuild them and make them larger than they were before in order to meet the demand of the training (Zatsiorsky & Kraemer, 2006). For hypertrophy to happen in great extend a certain repetition interval must be performed and exercises should be with specific intensity. This type of training will be discussed further later in this work.

However, it is not only the muscles that become stronger due to weight training. Studies conducted with people and animals show that tendon's stiffness increases over time due to training. As a response to muscle training in the long run stiffness happens as growth of the number of collagen fibrils in the tendon and increasing their density (Brumitt & Cuddeford, 2015). The more stiffness a tendon has, the greater force is required to stretch it. Some researchers suggest that increased work load will make tendons more prone to injury if progressive loading is not done accordingly and allowing enough time for accommodation.

On the other hand, with age and especially during and after menopause bone density and strength in women decrease. This makes the bones more fragile and increases the risk of fractures (Bacelar, Almeida, Sauaia, Novais, Furtado, Quintanilha, Pulcherio, Filho & Gambassi, 2015). One study examined the effects of resistance training on elderly women (63+/-3) over the course of 10 weeks. The results showed no significant increase or decrease in bone mass density (BMD). This might be interpreted in a way that weight training for elderly women might help preventing bone mass loss. Regarding younger female athletes one of the main reasons why weight training has not been highly recommended in the past for children and adolescents is because the effects on the skeletal system were rather unclear. For young girls and boys especially, it was believed that weight training can impair growth and damage the health of the bones. However, re-

search shows that the mineral content of the bones together with the bone strength index and BMD in young athletes have been shown to increase due to weight training (Legerlotz, Marzilger, Bohm & Arampatzis, 2016).

3 WEIGHT TRAINING APPLICATIONS AND HORMONAL RESPONSE

3.1 Weight training

According to Oxford dictionary weight training is *"physical training that involves lifting weights".* The dictionary also indicates resistance training as another term for weight training. This type of exercise has been recognized as one of the most efficient training interventions for inducing strength and muscle mass (American College of Sports Medicine, 1998). The weights used when working out can be barbells, kettle bells, dumbbells or other gym equipment which could be used as resistance. Weight training implies mobilizing a certain muscle group or groups into moving or lifting a weight for a given number of repetitions. There are different types of resistance training depending on the intensity and the volume. Strength training for instance is a type of resistance training that uses heavy weights so that a person's maximum repetition (MR) with them would be between 1 and 5 times per set (Zatsiorsky & Kraemer, 2006) as opposite to muscle hypertrophy training in which maximum repetitions per set would be between 5-7 and 10-12. (Figure 4) (Zatsiorsky & Kraemer, 2006, p.161). The difference is that when strength training is done and maximal weight load is used in the lift, the number of motor units which are activated is far bigger than when lighter weights are lifted for higher number of repetitions. As mentioned earlier in this work the more motor units are being recruit and activated during a set, the better is the neuromuscular adaptation. Strength gains achieved with higher maximum number of repetitions are smaller compared to those from low RM. As a further sup-

port to this claim, study conducted on untrained young and older women examined the neuromuscular adaptations and strength gains from 13-weeks low versus high volume resistance training. The results showed that *"additional strength gains and neuromuscular adaptations during the early phase of moderate-intensity resistance training in untrained young and older women may not be achieved by performing multiple sets."* (Cannon & Marino, *Journal of sports sciences,* 2010:1511).

Another example of weight training, one which implies higher number of repetitions per set (between 12 and 20 to 25) is considered muscle endurance training. This type of exercising increases the ability of a muscle to exert work for longer periods of time but will compromise strength and muscle mass gains.

Training variable	Muscle hypertrophy	Strength (neural factors)
Intent	To activate and exhaust working muscles	To recruit the maximal number of motor units with optimal discharge frequency
Intensity (RM)	From 5-7 to 10-12	1-5
Rest intervals between sets	Short (1-2 min)	Long (3-5 min)
Rest intervals between workouts emphasizing same muscle groups	Long (48-72 h)	Short (24-48 h)
Exercises in a workout	Three or fewer muscle groups (split system)	Many muscle groups
Exercise alternation in a workout	Flushing: exercises for the same muscle group may alternate; exercises for various groups do not alternate	Recommended
Training volume (load, repetitions, sets)	Larger (4-5 times)	Smaller (4-5 times)

Figure 4. Presenting different training protocols for increasing muscle size or muscle strength

3.2 Weight training effects on body composition and health

According to Kraemer & Zatsiorsky (2006) different intensity and different resistance levels have diverse physiological effects. The metabolic reaction for

combined both tearing of the muscle and the following protein synthesis depends widely on the intensity and resistance levels of the exercise. As previously mentioned, low range of the repetitions (between 1 and 5) promotes gains in strength but will not cause as many micro damages to the muscle as hypertrophy training (range rep between 5-7 and 10-12) to promote muscle size growth. Recovery period for strength training is short (24-48h) (Kraemer, 2006). Still, strength training requires increased protein intake for rebuilding and recovering. As it elevates the excessive post exercise oxygen consumption (EPOC) strength training keeps the metabolism elevated. If the individual's diet is rich in all nutrients and if the body is in negative energy balance, it will result in fat loss in the long run.

On the other hand, hypertrophy training requires longer rest periods (up to 72h) together with protein rich diet. The American College of Sport Nutrition recommends protein intake of 1.5 to 2.0 grams per kilogram bodyweight per day for individuals who do intensive training. When these requirements are met and when in caloric surplus the body will build lean muscle mass. If the goal is burning fat and building muscle mass at the same time, the body needs to be in caloric deficit but the protein intake needs to stay between the recommended.

The other type of weight training, for endurance, will most often not lead to building muscle mass. Nevertheless, since muscles are broken down during a workout recommended daily protein intake is 1.0 – 1.5 grams per kilogram body weight per day, higher than for sedentary individuals (0.8 – 1.0 g/kg/d). Similar to aerobic activities which are widely preferred by females, endurance weight training will increase the ability of one's muscles to perform over longer periods of time. Good example of endurance trend in weight training in the fitness industry is Body Pump. This workout type designed by LesMills Company in New Zealand incorporates light to moderate weights for high amount of repetitions working out all the major muscle groups. One study examined the effects of Body Pump on women's strength and body composition. The results showed that neither strength increased nor any observable changes in body composition were present (Rustaden, Haakstad, Paulsen & Bø, 2017).

The effects of weight training on body composition are highly dependent on the diet which is followed. Dieting alone, will indeed result in a weight loss but significant amount of this weight will be muscle mass. This is one of the reasons why fitness and health experts often do not prescribe diet without exercise. If a person does not receive enough nutrients, especially vitamins, minerals, essential amino acids and essential fats, this might lead to significant health problems. For females, these include decreased bone density, poor immune response and menstrual disorders among others. Young girls are at higher risk for disordered eating, problems with menstrual cycle or decreased BMD, according to the American Academy of Pediatrics (Larkin, 2000).

Common goal for men in training is to build muscle mass and increase their weight. On the opposite, women often impractically aim to lose weight and build muscle at the same time. As nowadays society creates unrealistic expectations for how women should look it is very important for females who engage in intensive exercise such as strength training to be educated about dieting when training and the effects it might have not only on body composition but also on bones, reproductive system and immune system.

Weight training styles can be different and can be used for variety of goals. One cannot argue the benefits of this type of exercise combined with a good healthy diet. Some of those benefits are enhanced bone strength, which reduces the risk of osteoporosis, enhanced connective tissue strength, higher metabolic rate, improved performance in sport and in daily life, decreased nonfunctional fat and increased lean body mass, decreased risk of injury and last but not least decreased risk of heart disease. Together with that it has been proven that weight training improves self-confidence and self-esteem. However, there still are numerous misconceptions regarding the topic, which limit the possible benefits due to usage of training programs which are inadequate. One popular myth is that women will become too masculine and large if they engage in weight training. In reality, as weight training leads to increased lean body mass and decreased body fat mass it can result in slight increase in the body weight because muscle mass is heavier that fat mass. However, increase in arm and leg circumference

in women due to weight training is insignificantly small (Zatsiorsky & Kraemer, 2006). Moreover, even though it has become evident that women can be trained with almost the same programs with which men are trained, there are far many physiological contrasts between their bodies which do not allow women to achieve identical to men's results. Therefore, women should not hold any fear of this sort regarding training and especially intensive and heavy resistance training. In fact, intensive training is needed to promote adaptations of the muscles, motor neurons and tendons.

HORMONAL RESPONCES

“Resistance exercise has been shown to elicit a significant acute hormonal response. It appears that this acute response is more critical to tissue growth and remodeling than chronic changes in resting hormonal concentrations, as many studies have not shown a significant change during resistance training despite increases in muscle strength and hypertrophy.”

Kraemer & Ratamess, 2005:340

3.3 Growth hormone response

The growth hormone (GH) is a protein which is secreted in the pituitary gland in the brain (Stoppani & Weubben, 2007). Some of the primary functions of growth hormone are promoting repair of muscle cells and growth and improving the release of stored fat from fat cells. Usually, during day time the levels of this hormone in the body are low. Once a person is asleep they peak to aid muscle repair and recovery and to release energy for body’s functions from fat stores since the body is fasting during the night. Growth hormone production responds positive to weight training. Studies have shown that it is linked to rise in the lactic acid levels. That means that the heavier the exercise is the more lactic acid circulates in the blood after the weight training session and more GH is being secreted by the pituitary gland (Gordon, Kraemer, Lynch & Knuttgen, 1994). When heavy weights are lifted the body responds with increase in the growth hormone levels in order to start the anabolic process of regenerating the muscle tissue. As already mentioned this increase also leads to higher usage of fat for energy after the training session.

One study conducted with 74 young healthy women examined the effects of acute and chronic resistance training on growth hormone levels. The women performed six sets of ten repetition maximum in a free back squat. Before and after the testing blood samples were collected. After the testing the women were to

follow a twenty-four-week resistance training program. The results from the blood samples taken after the 24 weeks training program showed that after the first exercise session the women had increased immune-active growth hormone levels but no changes in bioactive growth hormone. This means that there was an increase in growth hormone levels circulating in the blood but the bioactivity of growth hormone molecules was not elevated with acute exercise. After twenty-four weeks of training, however, increase in the bioactivity of the circulating growth hormone was observed (Kraemer, Nindl, Marx, Gotshalk, Bush, Welsch, Volek, Spiering, Maresh & Mastro, 2006). This means that chronic changes in GH concentrations come with long term training. Growth hormone production is higher when the intensity of the exercise is higher. If the rest between sets is short the result will be higher production of growth hormone as shown on Figure 5 (Goto, Ishii, Kizuka & Takamatsu, 2005).

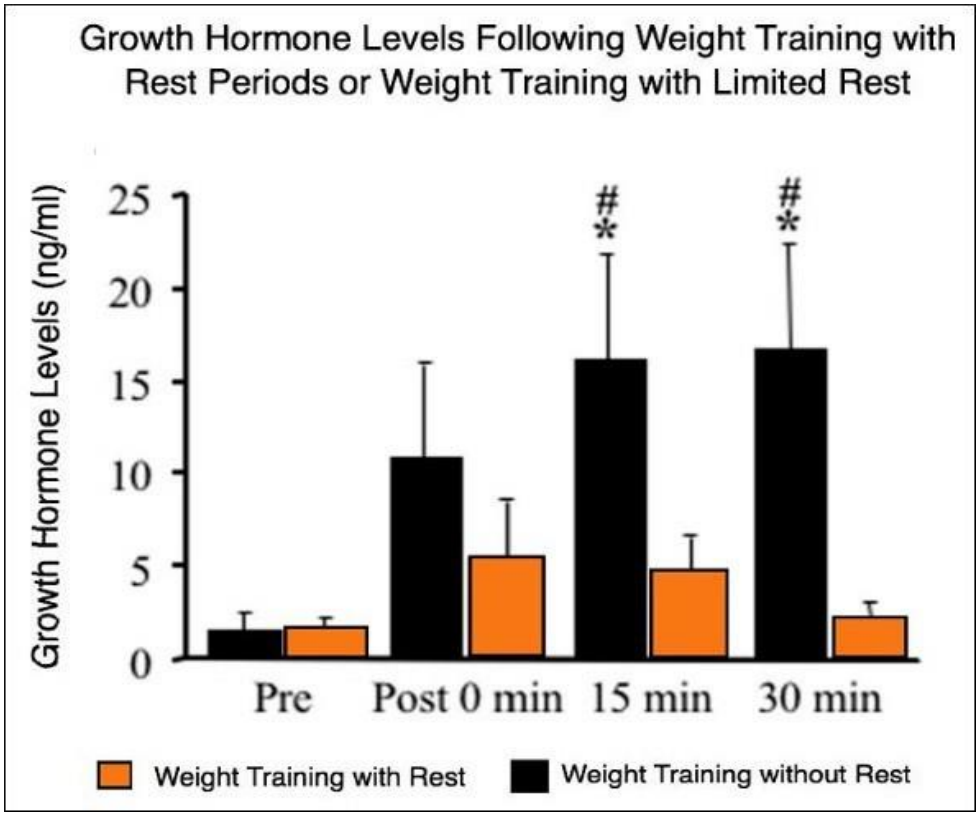

Figure 5. Difference in GH levels following no rest and with rest weight training.

3.4 Estrogen response

Estrogen is the female sex hormone. It is primary secreted by the ovaries but this secretion is dictated by the pituitary gland in the brain. It is released also by the adipose tissue in the female body and often has the bad reputation of being a weight gaining hormone. As its levels are higher in women than in men, women on average have higher body fat percentages than men. The backbone of this hormone and the male sex hormone (testosterone) is created with the help of cholesterol. Cholesterol is very essential component for sex hormones' production.

Estrone, estradiol, and estriol are the three main endogenous estrogens in females. Estrogen's main functions are developing, controlling and balancing the female reproductive system. It is also responsible for giving women the female features which they have and regulating the menstruation cycle (Nussey & Whitehead, 2001). The production of these hormones in women varies during the month. Changes in the levels of estrogen together with those of testosterone and progesterone during the menstruation cycle are displayed on the chart on Figure 6. (Retrieved from My Hormonology website

https://www.myhormonology.com/female-hormone-cycle/).

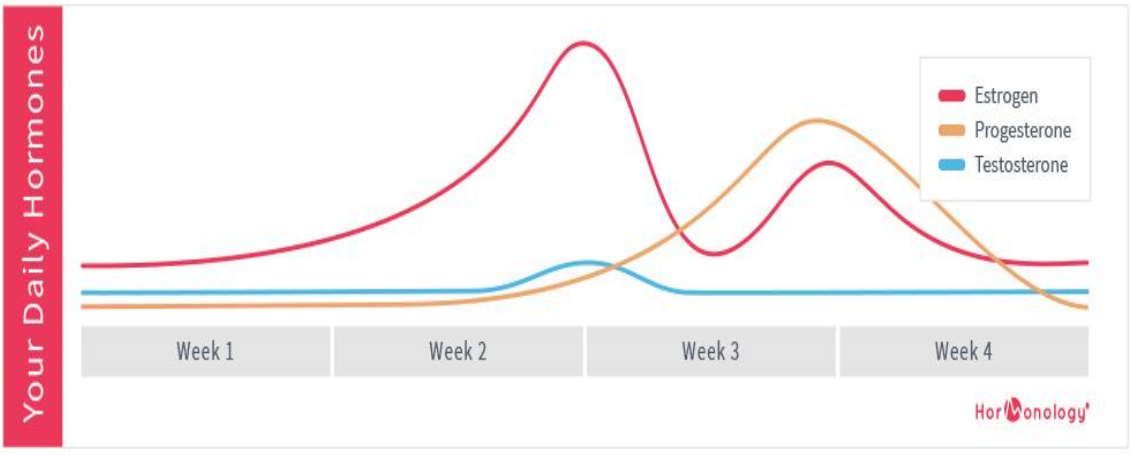

Figure 6. Changes in the levels of female sex hormones over the course of one menstrual cycle.

Some women produce more estrogen than others. Increased dietary fat intake and high body fat percentage have been proven to result in increased levels of circulating estrogen in the blood in women. According to BreastCancer.org higher estrogen levels significantly increase the risk of developing breast cancer, endometrial or ovarian cancer, which are ones of the most commonly met cancers among women. Previous studies have shown that exercise and/or restricted daily calorie intake can result in dive of the estrogen levels in overweight women. This is why exercise is often prescribed by health advisors to women whose estrogen levels are higher than the normal (Dusek, 2004).

Another interesting fact about this hormone is that its levels, together with vitamin D and calcium bioavailability, regulate bone growth and remodeling. In other words, estrogen plays important role in maintaining healthy strong bones (Manore, Meyer & Thompson, 2009). This is one of its vital functions and one important reason for women to address it with care when it comes to training.

The weight training response of estrogens has not been as widely studied as testosterone response. Kraemer has found that concentrations of estradiol in young women increase as acute response to one session of moderate intensity hypertrophy training (Kraemer, Heleniak, Tryniecki, Okazaki & Castracane, 1995). In a case when exercise is heavy and extensive and the body does not receive enough nutrients to recover from training and perform its vital functions, problems with menstruation might occur. They are present because of significantly lowered estrogen levels due to the too heavy training (Walberg-Rankin, Franke & Gwazdauskas, 1992). The reasons for that are numerous. If the intake of dietary fat is limited the female body does not receive the needed cholesterol to produce enough estrogen, releasing egg from the ovaries is impaired. Another example would be failure to fuel the body with enough energy and nutrients in general, to fuel for its vital functions together with the calories burned in training, which will disturb the hormonal system. In the long run this might lead to menstrual abnormalities such as dysmenorrhea, which is painful periods, amenorrhea, which means that there is absence of menstruation and oligomenorrhea which is irregular, prolonged or light menstrual cycles (Zatsiorsky & Kraemer, 2006). Low

estrogen levels due to the combination of heavy exercise and poor nutrient intake and especially restricted dietary fat intake will affect bone mass density (Dusek, 2004). In severe cases this might result in osteoporosis. Bones become weaker and due to excessive weight training they suffer micro fractures more often. Without adequate amount of nutrients and rest to recover these micro fractures do not heal and after time might result in a clear fracture of the bone called stress fracture. Interestingly, one study examined the effects of weight training on the bone strength in young women. The results implied that *"low-repetition high-impact movements are suggested to be one of the ideal training methods for enhancing and maintaining peak bone mass in young adult women."* (Kato, 2011:01). Furthermore, another study in 2013 examined the effects of weight training on young sedentary women over the course of twelve weeks. The participants engaged in specially designed hypertrophy training routine three times per week. The results showed increase in the concentrations of hormones responsible for bone formation.

Hormone concentration is widely affected by energy availability (which is the daily energy intake minus the calories burned in exercise). Therefore, estrogen is directly related to the combination of weight training and nutrition. Severe dieting together with heavy weight training routine for prolonged period of time results in critically low levels of body fat and is shown to disrupt the normal function of the ovaries and create insufficiencies in the secretion of estrogen (Redman & Loucks, 2005). This is why women who decide to engage in weight training, especially the kind of strength or muscle hypertrophy training need to ensure enough essential nutrients, meaning not only enough amino acids for muscle restoration but also healthy fatty acids to balance the hormonal system and absorb fat-soluble vitamins.

Apparently, with proper and healthy diet, rich in nutrients and consisted with enough calories to cover the daily energy needs of the female, estrogen levels can be maintained in a healthy range despite heavy weight training. Moreover, due to adaptations, enhancement of the bone mass density will be present. This type of training is important for women in post-menopause state because they

have lower levels of estrogen which leads to bone mass loses (Moghadasi & Siavashpour 2013).

3.5 Progesterone response

Progesterone is another of the primary hormones in the female body. It is important one because it is responsible for enforcing and setting different functions during the month. Adrenal glands, ovaries and placenta (if the woman is pregnant) produce this hormone. Progesterone prepares the body for pregnancy and regulates the menstrual cycle. Progesterone causes the uterine lining (endometrium) to release certain proteins during the luteal phase of the menstrual cycle, which prepare it to receive and nourish a possible implanted fertilized egg. If pregnancy occurs progesterone levels rise and play major role in maintaining it and for the growth of the baby. According to Goldstein (n.d.) another important role is controlling sexual desire. High volume and/or high-intensity exercise has been proved to reduce secretion of this hormone, distort the menstrual cycle and therefore decrease fertility in women. According to Furlong (2017), low production of progesterone can change and delay the menstrual cycle. This directly affects the ability to become pregnant. However, if weight training is performed at moderate rate it affects positively the production of progesterone and can actually help with normalizing irregular periods. It has been suggested that shorter duration activities of high intensity, sprints for instance, can positively affect and regulate the levels of progesterone, as long as these activities are not done in excessive amounts. Simply said, too intensive weight training without adequate recovery often results in low levels of progesterone and fertility problems, whereas moderate amounts of weight training are beneficial for progesterone production. Furthermore, according to Corbett (2014) women can so-to-speak "*harness*" their hormones and plan their workout routine according to their menstrual cycle. For example, the first fourteen days of the monthly cycle are linked to high levels of progesterone and estrogen, which makes women feel energetic and strong. This is when they should push their training beyond their usual limits, as Corbett

advises. In the next two weeks, when hormonal levels significantly drop women should focus more on maintenance and endurance training.

3.6 Testosterone response

Testosterone is an anabolic steroid which is the predominant sex hormone in males. It is related to building muscle mass and burning non-functional body fat. Although females have it too, testosterone concentrations in women are ten to twenty times lower than in men (Zatsiorsky & Kraemer, 2006). In the female body this hormone is produced in the ovaries and the adrenal glands. Testosterone has many functions in women's body. Even though adaptations to training in muscles, bones and tendons in women are primarily related to growth hormone, testosterone is also of great value for the building out of muscle mass and strength. This hormone is also important for females' energy levels, bone health, sexual desire and pleasure and thorough feeling of well-being.

It is commonly believed among women that heavy training increases testosterone levels in the female body and causes women to look masculine. However, majority of the studies which have examined the short term effects of resistance training on testosterone levels in females do not show remarkable changes in the circulating levels of this hormone. Still, women can build lean muscle mass and burn fat effectively. One study on men and women divided the participants in different groups according to gender and age (young age, middle age and elderly) and examined the acute hormonal responses to heavy resistance training in all groups. The results showed increase in testosterone levels concentration in all groups of men, but no significant increase in testosterone levels in women in any of the groups was observed (Hakkinen & Pakarinen, 1995). These responses are illustrated in Figure 7. (Zatsiorsky & Kraemer, 2006:183). As opposed to short term effects of weight training on testosterone levels studies on long term effects of training (> 6 months) seem to indicate increase in free testosterone and resting testosterone in women. This indicates the need of long term training to obtain

hormonal response (Hakkinen, Pakarinen, Kraemer, Newton & Alen, 2000). Still, this increase is not of great range, meaning that women should not fear that weight training will cause them to look masculine because they simply do not have the right amounts of testosterone for this to happen.

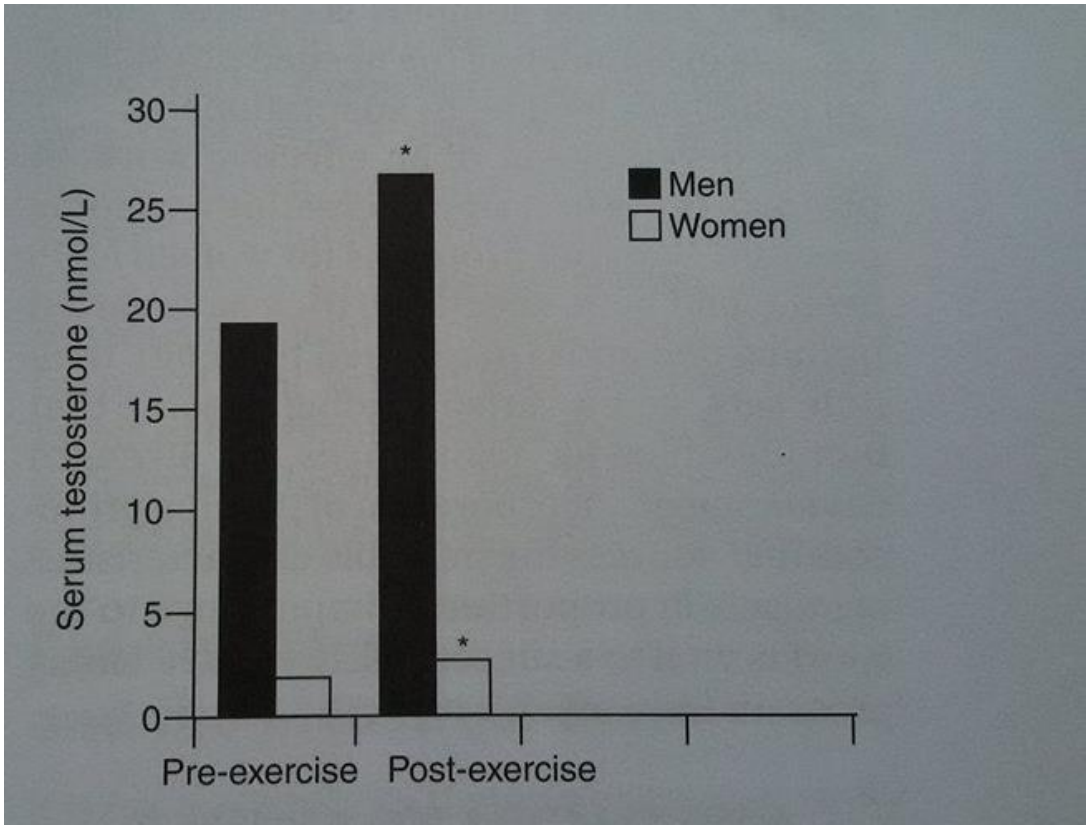

Figure 7.Compared acute response to weight training in men and women.

Endurance training, like distance running, has been shown to lower testosterone levels in women. Symptoms of unduly low testosterone levels in women include but are not limited to low energy levels, low libido, poor sleep and weight gain. On the other hand, weight training, especially shorter and more intensive workouts cause increase in the levels of free testosterone in women (Vingren, Kraemer, Ratamess, Anderson, Volek & Maresh, 2010). Some of the symptoms of high testosterone levels in females are excess body hair, acne, deepening of

the voice and irregular menstrual cycles. That means, females who have low levels of this hormone should incorporate more intensive and shorter weight training workouts whereas females who have high levels of testosterone in the blood should question themselves if they are not training too heavy and if they should lower the intensity of their workouts.

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4 SAFETY AND RECOVERY

After discussing the effects of weight training on the female hormones the focus of this work shifts to the safety requirements to which women need to pay attention. After heavy training session the body's state of homeostasis (or balance) is disturbed. Recovery after training refers to the ways in which the body restores the state of homeostasis (Comana, 2017). It is essential for adaptations to take place and to facilitate progress in training. The balance of the hormonal system is highly dependent on the diet. In this section importance of nutrition and dietary requirements are described as well as the importance of quality sleep and good training technique.

As Borkowski (2007) points out weight training is reason for approximately sixty thousand hospital visits every year. The cause of that commonly is either progressing in training too fast and without accurate supervision or lack of thorough or thoughtful training program planning. This is why it is very important not only for women but for men also to be vigilant when training and familiarize themselves with proper exercise technique, basic muscle care habits, as well as how to ensure recovery for the body outside of the training area, meaning good sleeping habits and diet choices.

4.1 Injury prevention

There are risks of injury in every type of sport. It is of great importance for people who train to know how to properly engage in exercising in order to minimize them. Many injuries are caused by exercising with poor technique. This is why weight training instructors need to teach correct exercise technique to their clients. Proper posture, use of adequate load and correct breathing are essential for preventing injury (Borkowski, 2007).

Zatsiorsky & Kraemer (2006) pointed out that for women who do weight training there are approximately 2.8 injuries per every one thousand training hours. They state this number as being rather low compared to injuries in other sports. Still, there are risks and women should take action to minimize them. According to Fox (2012) the most common injuries among women are sprained ankle, anterior knee pain syndrome (also called “runner’s knee”), stress fractures, concussions and meniscus tears. Whereas ankle sprains and fractures are hard to prevent, injuries such as tendonitis, muscle strains and overuse injuries can be minimized.

One of the ways in which this can be done is by correct planning of the training session. A proper workout routine begins with a warm up and finishes with a cool down. Well-altered changeover from warm up to the actual training is a great way to prevent injury. A training session should begin with a warm up which mimics the exercises which are to be done (Nadelen, 2016). For example, if the workout would focus on the muscles of the lower body the warm up should include two to three sets of squat, leg press or lunge with lighter or no resistance or movements like jumping jacks or squat jumps. This will increase the heart rate and will ensure an adequate blood and oxygen flow to the muscles which will be later worked, hence significantly reducing the risks of injury. The same applies to the cool down after a training session. As Nadelen (2016) points out, warm up in the beginning of a workout prepares the body for action in the same way the cool down and stretching afterwards slow down to normal the heart rate and return the body back to its normal condition. A good cool down could be jogging, walk-

ing or performing similar low intensity activity for five to ten minutes. One often neglected part of cool down, namely stretching, is vital for reducing delayed onset muscle soreness and will help increasing the blood flow and nutrients flow to the muscles, thus aiding in recovery.

Having an adequate progression in training is as equally important as having a good workout routine. Moderate increase in load over time will provide enough time to the neural and muscular systems to adapt. The most common injuries, which account on a total of 44 to 50 % in all injuries in strength training athletes are related to the lower back (Zatsiorsky & Kraemer, 2006). Reasons for these often are poor exercise technique or failing to “listen” to the signals which the body gives, such as pains and aches not only in the muscles but also in the joints and tendons, feeling of fatigue and tiredness or acute pain in the lower back after training. These are signs that should not be ignored.

To keep the training progression and exercise with safety, one must make sure to begin and end a workout with warm up and cool down, to listen to the signals of the body related to pain or fatigue and to know the proper technique of performing weight training exercises.

4.2 Nutrition requirements

After discussing the significance of adequate training planning it is worth mentioning the importance of a good and healthy diet. After many years of research on the position of nutrition in regard to health and training now the importance of it is clear (Manore, Meyer & Thompson, 2009). It is important not only for women but for children and men too to include different nutrients in their diet and to find a balance between the food they ingest and their level of physical activity. Daily macronutrient recommendations do not differ between men and women. Manore, Meyer & Thompson (2009) recommend between five to ten grams of carbohydrates per kilogram of body weight for individuals who do moderate to heavy training. This should amount on 45 % to 60 % of all energy consumed for the

day. Recommendations for fat intake are 20 % to 35 % of consumed daily energy and should not fall below 20 % as fat is needed for absorption of fat soluble vitamins. Women should intake at least 30 grams of dietary fat per day to ensure hormonal and menstrual balance. Regarding protein intake, it depends on what type of weight training is done. For individuals doing strength training Manore, Meyer & Thompson (2009) recommend an intake of 1.6 to 1.7 grams of protein per kilogram bodyweight per day. On the other hand, weight training for hypertrophy would require higher intake of protein (2 to 2.4 g/kg/d). According to the American College of Sport Nutrition, the International Olympic Committee and the International Society for Sports Nutrition (2013) people who engage in moderate to highly intensive training should consume between 1 and 2 grams of protein per kilogram bodyweight. If the goal is to lose non-functional body fat increased intake of protein, such as 2 to 2.4 grams per kilogram bodyweight per day, depending on how high the caloric deficit is, is recommended. Such amount of protein can prevent loss of lean muscle mass during stages of caloric restriction which promote fat loss.

However, besides protein, carbohydrates and fat, women need to pay attention to their dietary intake of vitamins, minerals and water. According to Harvard men's health watch (2006) the recommended daily allowance (RDA) for most vitamins and minerals is the same for men and women. However, there are some differences. For example, women's bodies would require higher intake of the mineral iron since they lose some of it every month with menstruation. Also, calcium intake is critically important for women as the risk of osteoporosis is higher for them than it is for men. One example of elevated vitamin needs for women who train is the need of vitamin B2 (riboflavin) which is very important for normal body functioning. Manore, Meyer & Thompson (2009) point out that series of metabolic studies conducted with physically active women show that the needed levels of this vitamin increase due to training. As an advice to women who plan to engage in weight training or are already training experts signal the importance of consulting with medical representative regarding vitamins, minerals and macronutrients needs.

It is essential to consider also the importance of water as a nutrient for normal body functioning and for training. Its significance has been widely discussed in the past. What has been proven many times in different studies is that exercise, especially in hot environment increases the loss of water and electrolytes and brings the need for higher water intake Manore, Meyer & Thompson (2009). If these needs are left unmet the body goes into hypo-hydration (the stage which leads to dehydration) where muscle cramps or headaches might occur due to low levels of water and sodium which are lost with sweat. Furthermore, as Carlson shares with WebMD (2009) loss of only 2 % of a person's body weight in fluid can significantly worsen and decrease exercise performance by as much as 25%. According to MacGill (2016) the average amount of water in and adult's human body is between 50 % and 70 %. This claim is further supported by Manore, Meyer & Thompson (2009) who add that water makes up close to 74 % of lean body mass and approximately 20 % to 30 % of body fat tissue. This means that women, as they usually have higher fat percentage, have lower water percentage in their bodies than men. Average body water percentage of men is 60 % to 65 % whereas of women it is 50 % to 55 %. Despite these differences between men and women it has often been cited until the recent past that recommended water intake for adult individuals per day is eight glasses of water. MacGill (2016) argues that this claim is not supported by any scientific evidence. He further calls this recommendation a "one-size-fits-all mantra" which does not take into account differences between individuals. Instead, he suggests that adequate water consumption for women between 19 and 30 years old should be 2.7 liters per day taken not only from water but also from all food sources. Regarding exercise of any kind, he states that general recommendations for water intake cannot be given as perspiration rate varies from person to person and as factors like gender, body composition and metabolism have too great of an influence. To ensure adequate hydration state women (and same is valid for men too) should simply follow the sense of thirst.

As a closure to this section it is worth mentioning that inadequate macro- and micronutrient consumption, poor diet habits or inadequate caloric intake might

lead to health problems, in this number also menstrual problems (Zatsiorsky & Kraemer, 2006). As already mentioned previously in this work, the most common menstrual problems which occur due to combination of severe caloric restriction and heavy exercise are amenorrhea, dysmenorrhea and oligomenorrhea. These problems are one of the three components of what is called female athlete triad. The triad refers to three factors which affect and can damage female's health and performance. The second one is disordered eating. As nowadays society often imposes unrealistic expectations of how the female body should look, many women, especially young girls, have diminished their self-esteem and have developed eating disorders such as bulimia nervosa (forced purging) and anorexia nervosa (self-starvation) (Zatsiorsky & Kraemer, 2006). In this case weight training will not only fail to be beneficial for the female's health but will actually worsen her health condition. The third problem part of the female athlete triad is one that has already been discussed earlier in this work, namely osteoporosis. Despite the fact that weight training is important component of osteoporosis intervention, if it is done while the body does not receive enough calories to build and strengthen all tissues including bone mass it will have negative effect on BMD. To ensure healthy bones, hormonal system functioning and healthy status in general while engaging with weight training, women need to follow the recommendations and ensure proper nourishment for their bodies.

4.3 Sleep

After revising the importance of nutrition, it is sensible to emphasize sleep as equally important for recovery as nutrition and rest. The significance of its quality matters not only for training but for overall health and wellbeing and has been widely recognized (Comana, 2017). Insufficient amount of sleep will have a negative effect on training and exercise performance. Training, especially heavy and late night training can have effect on the quality of sleep. The term "basal sleep" refers to the minimum amount of sleep which the body requires at night in order to recover and rest. Sleep debt occurs and accumulates when the body does not

receive the required basal sleep. Studies show that over very short period of time, such as a week of insufficient amount of sleep, people can experience decreased exercise performance, alternation in mood such as feeling of depression, fatigue or disorientation.

As already mentioned sleep is essential not only for exercise performance but for overall quality of life. One study conducted in Sweden examined and compared the effects of sleep deprivation on working memory on men and women. The results showed that negative effects of sleep deprivation are more present in women than in men (Rångtell, Karamchedu, Andersson, Liethof, Búcaro, Lampola, Schiöth, Cedernaes & Benedict, 2018). Another study examined the effects of sleep deprivation on exercise performance. Apparently, lack of sleep which lasts from 30 to 72 hours did not have significant effect on the aerobic and anaerobic exercise quality of the tested participants. Strength was not affected either. However, participants showed decreased time to exhaustion meaning their endurance capacity was reduced (VanHelder & Radomski, 1989). Sleep timing also affects the levels of physical activity on the next day. As one study from Utah, US showed, every hour of sleep after 07:30 in the morning resulted in significant drop in the levels of physical activity of the 375 women who were tested for one week.

Interestingly, and as mentioned already, it is not only sleep that affects the exercise quality. Exercise rate can also affect the quality of sleep. It is known that exercise in general improves the quality of sleep. However, in the recent past it was widely assumed that heavy training (including weight training and HIIT) performed at as little as 2 to 3 hours before the usual bed time results in a phenomenon called post-workout insomnia (Mercola, 2015). In order to ensure that training will not interfere with good quality of sleep, experts advise for implementing the training sessions in the mornings or afternoons. It is intriguing, however, that more recent studies show that heavy training late at night has a positive effect on sleep quality. One study on 52 high school students examined the effects of late night training (90 minutes before bed time) on the quality of sleep. Participants reported better sleep after the exercise. However, since the study covered only

one night, the effects of late night training in the long run are still unclear. Training indeed has a positive effect on sleep, yet still in some cases people experience post-exercise insomnia. Experts advise individuals who experience this phenomenon to plan and implement their training at the same time during the day to create familiar routine for their bodies and if possible to do their training in the mornings (Lehman, 2014).

4.4 Signs of overtraining

There is a certain rate at which every individual adapts to training load and progress and his or her body should not be pushed over its own limits of development (Wilmore & Costill, 1994). Most of the weight training programs incorporate increase in the load, volume or intensity over time. Although this is correct in order to have a progress, people often misjudge their own rate of recovery and their own level of skills which rarely leads to undertraining but often to overtraining. Overtraining results when an individual loads his or her body with more than it can tolerate. This renders excessive stress on the body and limits its ability to recover properly. If recovery is insufficient over longer period of time performance in weight training can significantly decrease. Some of the symptoms of overtraining are reduced appetite, problems with sleep, induced blood pressure, and reduced weight. According to Wilmore & Costill (1994), many of those symptoms are not usually linked to overtraining before a significant drop in exercise performance has been observed. This is why it is very important for people who engage in weight training, especially hypertrophy training, to give their bodies enough rest time between sessions to recover. According to Franco (2004) beginners in weight training should train 2 to 3 times per week and never exercise the same muscles on two consecutive days. For women advanced in weight training four sessions per week no longer than an hour would be more than enough. This is also suggested by Aaronson (2009), who adds that despite the fact that weight training, and in particular strength training, is far more effective for fat loss than cardio exercise, only about one fifth of women in the United

States engage in it the recommended two or more times per week. However, to avoid the risk of overtraining women should engage in no more than 3 to 4 heavy training sessions per week.

5 RESEARCH TASKS

As mentioned briefly in the beginning of this report the purpose of this work is to create ten exercise technique videos for the clients of the commissioning party and in particular the female clients. The second task connected to this work is to create three Power Point lecture presentations which incorporate the information found and included in the thesis report. The reason for agreeing on these two tasks with the commissioning party was that in this way clients would have access to quality information regarding the effects of weight training on women and in case they decide that this type of training would be beneficial for them and their lifestyle they cloud use the exercise technique videos to safely engage in working out.

6 PRODUCT DEVELOPMENT PROCESS

6.1 Technique videos

To ensure product coverage of exercises for all major muscle groups the author included in the videos exercises for chest, shoulders, biceps, triceps, abdominals, lower and upper back muscles as well as quadriceps, knee flexors and gluteus muscles. If performed in one session, the exercises add up on a full-body workout. The technique videos could be used by clients after they plan their own workout splits without the need of further professional supervision or technique coaching. Scientific knowledge collected from strength coaches and physical

therapists was used as a background to every video in order to teach safe and correct technique.

6.1.1 Planning

The video plan for each exercise video included list of the primary muscles involved in the movement. Description of the correct technique was included together with important notes to make in the video regarding common mistakes or risks of injury where needed to be mentioned. The manuscripts were simple yet they covered all the important points to make when instructing. The author planed that the videos would be no more than 90 seconds long each so that they are brief, on point and exact. The plans for the videos can be found at the Appendix 1 and the end of this document.

6.1.2 Filming

The plan for the filming was that the videos should be filmed in the gym in Tieto 2 on the campus of Kajaani University. The equipment which was to be used during the filming process was only from Tieto 2 gym. The idea behind this was that since the clients of Myötätuuli Learning Clinic are using mainly this gym, it would be easier for them to understand and learn the correct movements if they see how they are performed using the same equipment as they are using. A fellow student volunteered to help with the filming by being the one holding the camera. The only person who was allowed to be shown in the videos and who would demonstrate the correct technique was the author of the thesis. Therefore, no additional agreement for publishing was to be needed.

6.1.3 Editing

The editing part of the project was to be implemented by the author of the thesis alone. Basic video editing app called VideoShop was to be used. The editing itself was planned to last one week. The videos would include voiceover instructions recorded by the author of the thesis. The music which were to be included in the videos was taken from a website called freemusicarchive.org which offers music labeled for repetitive use. Therefore, no license was needed to be obtain prior to publishing the videos.

6.2 PowerPoint presentations

The theoretical information which was presented in the thesis report was divided into three parts as follows: Muscle and muscle's response to training; Weight training applications and hormonal response; Safety and recovery. Every presentation had to cover one of the topics and the information to be presented in rather easy to understand by the average reader way. The PowerPoint presentations had to be made in a fun and user friendly way so that there is no need for a lecturer to teach them. Of course, if the commissioning party wishes to teach the lectures using the slides, they could do so. The pictures which were to be included in the presentations were labeled for reuse from their respective owners. Therefore, there was no need for obtaining license prior to publishing the PowerPoint presentations.

6.3 Copyrights

The copyrights for both the exercise technique videos and the PowerPoint presentations are owned by the commissioning party and the author of the thesis as stated in the commissioning agreement.

7 CONCLUSION

By the time of finishing this report the exercise technique videos and the PowerPoint presentations were still to be published on the website of the commissioning party. The author put her very best efforts into this work and made sure that both the products are simple yet of good quality and most importantly successful in helping commissioning party's clients in their training and injury prevention. As the process started in autumn 2017, the author did not struggle with any deadlines and managed to complete the thesis project in time and according to her on schedule.

7.1 Product assessment

The aim of the author was to create quality and at the same time simple technique videos which the clients of Myötätuuli would use in their training. Therefore, simple language without too many scientific terms was used in the voiceover instructing. The main purpose of the videos was to educate clients and help with preventing injuries due to incorrect technique. The videos are filmed in the gym on Kajaani University campus (Tieto 2) according to plan so that clients can see the same equipment they usually use and find it easier to learn the technique. The video script (see Appendix 1) was very useful to the author and made the filming process easy and organized. The movements were chosen earlier in the thesis process and that saved time during the product development part.

The main purpose of the PowerPoint presentations was to educate clients by presenting the theory used in this research. They had to cover the most important information included in the thesis report and present it in a user-friendly, easy to understand and fun way. The author made the presentations in a way so that clients do not need a teacher to present and explain the knowledge but they

could simply read through them alone. However, as mentioned already, the commissioning party is able to use the presentations in their teaching.

The presentations include information as to how many repetitions per set and with how heavy weights clients could exercise depending on their goal. The author wanted to create both the products in accordance and in a way so that clients could use them as a tool to plan their workouts and exercise safely without any further instruction needed.

The whole product was critically revised and assessed by the author during the whole thesis process to ensure its correctness and professional outlook.

7.2 Reliability

In order for the thesis report and its products to be reliable the author critically examined every source which was used. The databases which were used to find sources was mostly scientific platforms together with scholar materials and materials from Kajaani University's library. Most of the sources included professional studies done with women to ensure the relevancy of data included in the report as its topic regards women in weight training. The author ensures that all of the information included in the thesis report was double-checked for its relevancy and the products presented to the commissioning party are created using only scientific information of good quality. Additionally, the author declares that all the text included in the report represents her own work besides the included quotations.

7.3 Accomplishments

The thesis process started early enough so that the author had enough time to go in depth of every source used. That improved her critical thinking. Her choice to work on this topic was driven by her primary interest of the topic of women in

weight training. Being interested in the work, this whole project was pleasurable experience for the author. Her knowledge on the topic expanded greatly and her research skills, expertise in the topic and self-organizational skills improved significantly which she believes will reflect in her working life. Everything learned during this project can be seen in the products presented to the commissioning party. The author believes that the thesis as a whole will benefit her future career and will facilitate her work with female clients. She believes the learning objectives which were part of this project were met to a great extent.

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APPENDICES

INCLINED BENCH BICEP CURL

Muscles involved:
Biceps brachii
Brachialis
Anterior deltoid
Brachioradialis

Correct technique:
Sit down and lean back on an inclined bench keeping two dumbbells in your hands using overhand grip. Let your arms fully relax down to your sides towards the ground. Keep the palms of your hands facing one another. From this position inhale and as you are exhaling flex your arms and bring the dumbbells up towards your shoulders. During the motion rotate your palms externally into supination and when the elbows are fully flexed bring them up a few inches to create even further flexion of the biceps. Slowly bring the weights down in the initial position in a controlled movement. It is important that you ensure you are not swinging the weights and using momentum to help you complete the rep.

TRICEP PUSHDOWN

Muscles involved:
Triceps brachii (lateral, medial and long head)
Anconeus

Correct technique:

Stand facing the machine with your feet placed at shoulder width. Grab the handle (or the rope) using overhand grip. Keep the elbows tucked into the body and if it feels comfortable for you lean your whole body slightly forward. Inhale and as you are exhaling extend the forearms as far as your elbows' range of motion allows you. Slowly flex your forearms to bring the weight down and stretch the triceps. Make sure your elbows are not moving during the repetitions and that you are controlling the eccentric phase of the exercise. Common mistake is swinging the elbows up and then down on a rep but this will take the focus of the exercise away of the muscle it is supposed to target.

SHOULDER PRESS

Muscles involved:
Deltoid (anterior, middle and posterior head)
Triceps brachii (lateral, medial and long head)

Correct technique:
Perform this exercise preferably standing to ensure involvement of the core stabilizing muscles. Hold two dumbbells in your hands using overhand grip. Keep your back straight, shoulders relaxed and your feet at shoulder width. Raise the weights to the level of your shoulders to get in starting position. Breathe in and as you breathe out lift the dumbbells up over your head. Make sure your elbows are always perpendicular to the ground and the weight is always above your elbow joint. On the eccentric phase of the exercise (when you bring the weights down) avoid lowering your elbows past your chest. This way you will keep the deltoid muscle engaged at all times during the exercise. Key point for this exercise is that you should keep your elbows slightly in front of you (at approximately 30-degree angle) and not next to the sides of your body. By performing the exercise in this correct way you will significantly lower the risk of injury of the rotator cuff.

STRAIGHT ARM PULLDOWN

Muscles involved:
Latissimus dorsi
Teres major
Triceps brachii (long head)

Correct technique:
Stand facing the machine with your feet placed at shoulder width. Grab the handle using overhand grip. Lean your upper body forward to a 45-degree angle to feel a slight stretch in the latissimus muscle. Your arms straight up should be in an alignment with your upper body. Keep your back straight, neck neutral and engage your core muscles. Inhale and as you exhale pull the handle down towards your hips without flexing the forearms. Control the movement on the eccentric phase and avoid swinging your body. Instead, keep it tight.

BACK EXTENSION

Muscles involved:
Quadratus lumborum
Iliocostalis lumborum
Biceps femoris (short and long head)
Semimembranosus
Semitendinosus
Gluteus maximus
Spinalis thoracis
Longissimus thoracis
Iliocostalis thoracis

Correct technique:

Place yourself comfortable on the roman chair so that the pads are right under your hip bones. If you are not using weight keep your forearms crossed over your chest. If you are using weight keep it close to your body at the level of your chest. Keep your back straight and neck neutral. It is very important that you don't try to look forward or keep your head up during this exercise as this will place unnecessary tension on your neck. Inhale and lower your upper body as far as your flexibility allows you. It is important that this movement is well controlled and you are not swinging your body. As you exhale bring back up your upper body to the point where your whole body is in one line. Do not hyperextend the back any further as this will place additional strain on your lumbar spine.

ROMANIAN DEADLIFT WITH DUMBBELLS

Muscles involved:

Gluteus maximus
Biceps femoris
Semitendinosus
Semimembranosus
Adductor magnus

Correct technique:

Begin with a position of your feet at hip width holding dumbbells in your hands using overhand grip. Allow your knees to bend just slightly and this is how you have to keep them during the exercise. Engage your core muscles to ensure your back is straight. Start the movement by flexing your hips and driving them backwards while sliding your arms down your hips together with the weights. Do not flex your elbows. Go as low as your flexibility allows you and then slowly bring your body back to the initial position. It is very important that you are not rounding your back during this exercise and thus making it susceptible to injury.

TRADITIONAL DEADLIFT

Muscles involved:
Rectus femoris
Vastus lateralis
Vastus medialis
Biceps femoris
Gluteus maximus
Rectus abdominis
Obliques
Trapezius

Correct technique:
Place your feet under the bar at hip width so that your shins are about an inch away from it. As you squat down to grab the bar your shins should touch it. Remember to keep your back straight and your neck neutral during the whole exercise as failing to do so will dramatically increase the risk of lower back injury. Grab the bar using overhand grip at width so that your hands are just outside your hips. Inhale and keep your chest proud facing forward. This movement is composed of two parts. First you extend the knee joint, allowing the bar to slide up your shins until it reaches your knees. From here drive your hips forward and slide the bar further up your legs until you are in a fully upright position. Exhale when you are up straight. Do not hyperextend the back as this might cause injury. From here slowly flex your hips but keep the knees extended allowing the bar to slide down your legs. When it reaches your knees stop flexing the hip and flex the knees to bring the bar to the ground. Make sure your knees are always bending in the direction of your toes.

BENCH PRESS

Muscles involved:
Pectoralis major
Deltoid (anterior head)
Triceps brachii (long and short head)

Correct technique:
Place the bar on the rack low enough because when you lay down and reach to grab it your elbows should not extend fully. Lay down on the bench so that the bar is right above your eyes. Place your feet right under your knees so that you can use your legs to push the ground as you lift. This adds balance and strength. Grab the bar using overhand grip wide enough so that when you bring it down to your chest your forearms are perpendicular to the ground. Inhale, tighten your core, pull your shoulder blades back and stick your chest up. Lift the bar from the rack and lower it until it touches your chest. From here push it back up and exhale at the end of the movement. If your shoulders have been previously injured, you might want to shorten the depth of the lift and not allow the bar to touch your chest.

LEG PRESS

Muscles involved:
Rectus femoris
Vastus lateralis
Vastus medialis
Vastus intermedius
Gluteus maximus

Correct technique:

Sit down on the machine and place your feet on the plate in front of you at a shoulder or hip width. Your knees should be going forward as you flex them in the same direction as your toes. Inhale and push the plate away from you allowing your knees to extend. Exhale at the end of the push. Do not extend your legs fully and never lock out your knees when doing leg press exercise as this puts serious pressure on your knee joints and can cause injury. In a controlled movement flex your knees to bring the weight down until you feel your glutes will start lifting up from the seat. If you have had injuries with your knees do not flex them more than 90 degrees.

CABLE CRUNCH

Muscles involved:
Rectus abdominis
External obliques

Correct technique:
Facing the machine, grab the rope using overhand grip. Place the rope on your neck, the two handles on your chest and hold it firmly. Get down on your knees. Inhale and squeeze your abdominals inwards. Arc your back forward and drive your chin in the direction of your knees so that your elbows touch your knees. Exhale at the end of the move. Slowly extend your torso back up. Remember to keep your hips and arms stationary during the whole movement and do not use your hip flexors to help you complete the rep.