The Best Recovery Strategies for Better Workout Results

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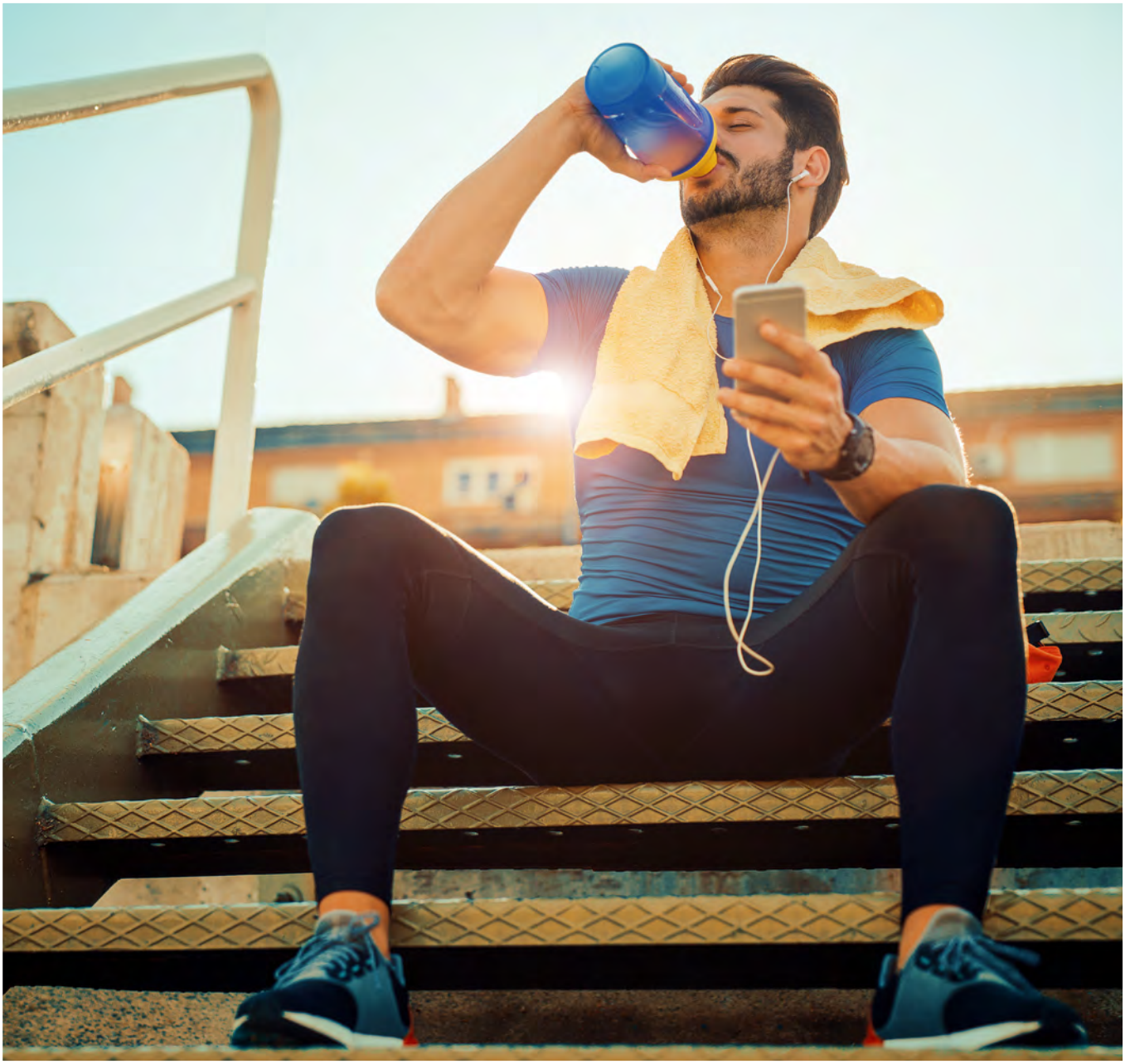
UNIT ONE

Rest Versus Recovery



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Scheduled rest is essential to exercise programming because it helps to provide the time muscles need to recover, repair, and become stronger. Scheduling rest periods also prevents overtraining; however, if there is too little rest, muscles do not adequately repair after a workout and muscles cannot undergo the processes of growth. In that case, performance results are minimal and if prolonged overtraining occurs, injury can result. If there is too much rest, detraining can occur. There is a balance between adequate rest for muscle recovery and regeneration, versus too much rest that leads to detraining and undermines muscle growth and performance. The key to finding a balance between too much and too little rest is to schedule rest both while training and during post-training recovery periods.

While rest is relatively *passive*, recovery is *active*. Recovery during a high-intensity cardiovascular workout might look like 20-second sprint intervals followed by 30 seconds to one minute of walking to recover, and then sprint again. Rest, although it can be active like walking, it is more likely to be defined as passive, like taking a day off from the gym entirely. How rest is considered and programmed during and between workouts is the key to defining and utilizing it to the exerciser's greatest advantage.

Regardless of the duration of rest periods—whether they are five seconds between repetitions during resistance training or 48 hours for a full recovery to baseline strength—effective use of rest requires strategic workout programming, day-to-day and on a weekly basis. It also requires an understanding of different modalities of rest and recovery, like sleep and meditation.

Rest During Resistance Training

Rest is an exercise programming variable that needs to be scheduled like any other training variable. Rest-while-training is paramount to work hard enough so muscles and the cardiovascular system are stressed enough to force physiological adaptation.

INTER-SET VERSUS INTRA-SET REST BREAKS

Traditional, resistance training programming uses between-set rest breaks or inter-set training. For example, the exerciser would do a set of ten, rest for 30 seconds, and complete another set of ten. As effective as this training method has been, recently traditional set training has been challenged, and with good reason—it causes muscle fatigue which leads to decreased force production over a set. Decreased force production over a set can interfere with both muscle performance and gains during a workout and over time. In particular, when fatigue sets in for the last few repetitions of a set, the efficacy of the overall workout is less.

Rest During Cardiovascular Training

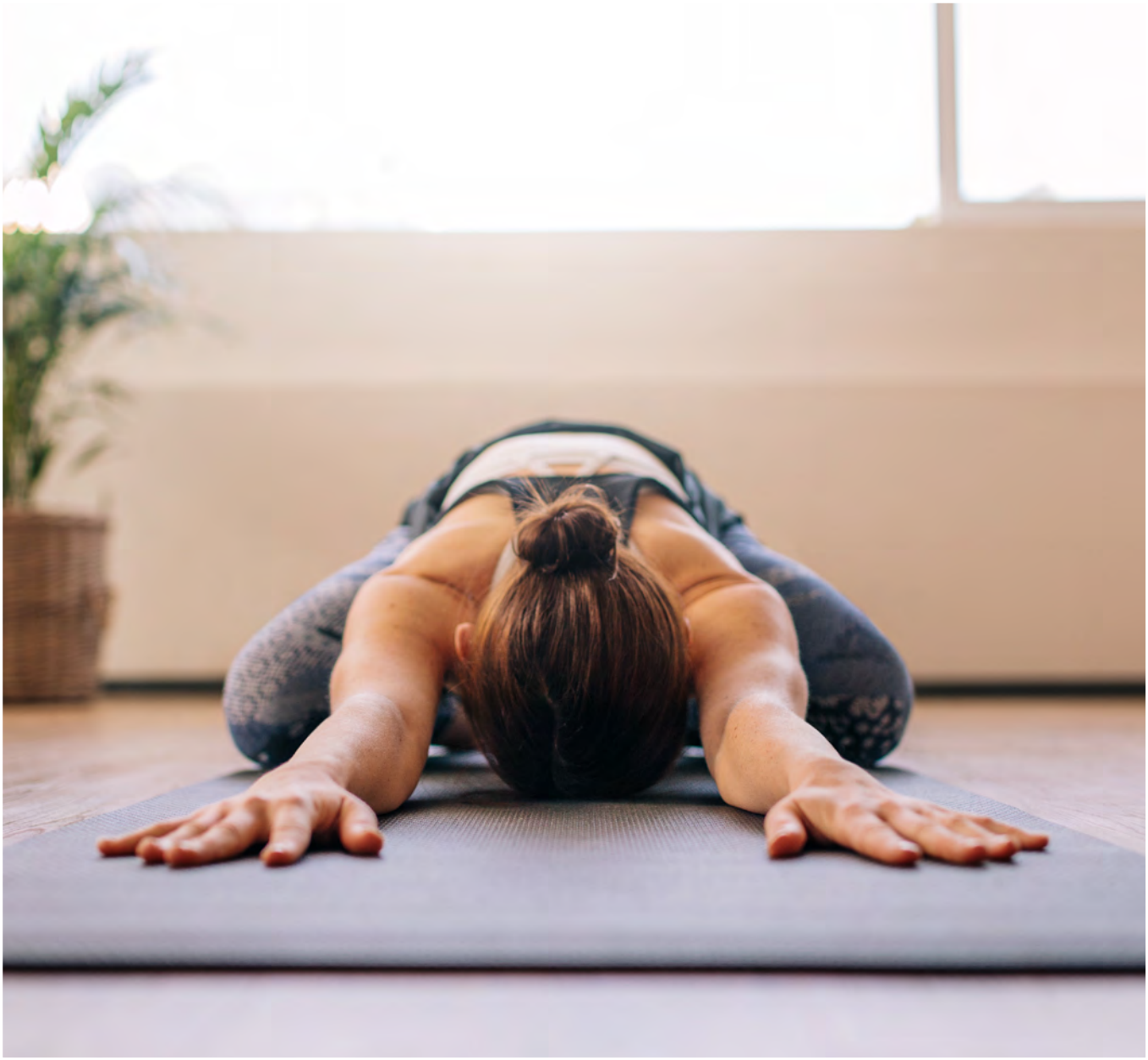
For programming rest, the two methods of cardiovascular exercise programming examined are continuous training (CT) and high-intensity interval training (HIIT). CT is defined as cardiovascular exercise that is sustained over a certain period at the same or similar intensity. In other words, with CT, the heart rate remains relatively stable throughout the exercise period.

Whereas CT is a moderate form of cardiovascular exercise, HIIT is defined as short bursts of above 85% maximum intensity followed by a period of rest and then repeated. The work-rest ratios for HIIT are determined by the intensity of the workload and the goal. Normally, the higher the intensity of the work period, the longer the rest period should be and vice versa. During HIIT, minimal muscle and cardiovascular recovery is allowed, similar to the use of intra-set rest periods during resistance training.

HIIT has been shown to have muscle performance outcome advantages over CT; specifically, longer-duration cardiovascular endurance training is more adverse than HIIT sessions on muscle mass, strength, and power outcomes (Fyfe, 2014). CT depletes substrates necessary for muscle mass, strength, and power outcomes, and the prolonged muscle contractions associated with CT adversely affect the ability of muscle to contract most efficiently during resistance training.

UNIT TWO

Active Recovery and Stretching



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Active Recovery

The distinction between rest and recovery is critical. Rest is what an athlete does during and after working out and is a piece of the scheduling puzzle. Active recovery includes modes of exercise like stretching and aquatics. Whether rest is characterized by a day off completely or an active day like swimming, the key is to remember that recovery is active—physiological processes are occurring that translate into improved muscle performance.

Recovery, on the other hand, occurs both during sessions and after, and is characterized by a series of active, ongoing physiological events associated with muscle repair and regeneration that translate into muscle hypertrophy, strength, and power development.

Recovery is active. During exercise, active recovery is something like walking or dynamic stretching between sets. When moving around between sets, you are readying your muscles and other supporting systems like the heart for the next set. You are allowing minimal recovery of things like chemical repletion at the nerve to allow for more efficient muscle contraction. After training, recovery is even more vital. It is during recovery that the rebuilding of muscle occurs.

Stretching

Flexibility is defined as the ability of a muscle to relax and yield to stress caused by the muscle lengthening. Flexibility exercises are designed to lengthen a muscle from its origin to its insertion—stretching a muscle from one end to the other.

Whereas stretching is something that muscles can do naturally, the extent of stretching is determined by a muscle's inherent and learned pliability. This, in turn, determines a joint's full range of motion (ROM) and is a critical component to overall health and fitness. ROM is the maximal movement or greatest angle change allowed at a joint. ROM is influenced by the ability of tendons and ligaments to stretch. Factors influencing flexibility and joint ROM include, but are not limited to age, sex (women are generally more flexible than men), and prior level and type of activity.

A muscle's capability to produce force and thus strength, speed, and endurance is a direct consequence of its length and flexibility. A muscle produces its greatest force just beyond its natural resting length. A stretched muscle produces greater force and thus greater strength and speed than a shortened muscle.

Beyond muscle performance, stretching is also related to the maintenance of tasks of daily living, including posture, balance, walking, and standing from a seated position. Muscle health and thus flexibility directly impact pain management, comfort, joint health, successful aging, and overall quality of life.

Self-Stretching

There are two different types of self-stretching:

- Static (no movement)
- Dynamic (movement)

Both are active types of stretching, even if the noticeable movement is not present, like in static stretching. The muscle is still active and more than likely there is resistance applied to the muscle by the exerciser to maintain the stretched position. The term dynamic refers to types of stretching where the exerciser is continuously moving like traditional callisthenic exercises.

STATIC STRETCHING

In physics, a static system is defined as a system that does not change. When a person does static stretching, they put the muscle in a stretched position and hold it there. This type of stretching is recommended post-exercise.

DYNAMIC STRETCHING

A dynamic system changes positions in a controlled way. The human body during movement is a dynamic system, like during walking or active stretching. A dynamic system is subject to change positions and does so frequently. Active, dynamic stretching is often used pre-exercise as a rhythmic or light warm-up.

GOLGI TENDON ORGAN

The Golgi tendon organ (GTO) is a small structure located in the tendon that detects the upper limits of a joint's range of motion. It is a built-in defense system that prevents the muscle from overstretching or the joints from overextending. When a muscle is in a stretched position, it stimulates the GTOs and that helps to relax the muscle. Additionally, the muscle on the opposite side from the stretched muscle (the antagonist muscle) relaxes and allows the targeted muscle or muscles to stretch more. And finally, when the GTO is activated during stretching, it sends a signal to the brain via the afferent or sensory nerve, which causes a series of events in the brain, ultimately sending a signal via the efferent or motor nerve back to the same muscle to relax. This entire process is termed autogenic inhibition (AI). AI allows the target muscle to stretch a little more and increases muscle pliability and flexibility.

MUSCLE SPINDLES

Another key physiological event is reciprocal inhibition (RI). RI is controlled by the muscle spindles, which are tiny re-ceptors that lie parallel to the muscle fibers and detect muscle length or stretch. When activated, the muscle spindles send a signal to the brain via afferent or sensory nerves and the brain sends back a signal via motor (brain to muscle) nerves to tell the opposing or opposite muscles to relax. Termed the stretch reflex, this action allows more stretch of the target muscle.

Without it, the joint would be rigid and immovable because the two opposing muscles on opposite sides of the joint would both be contracted—neither shortening to allow the other to lengthen. If the stretch stimulus is too much, fearing for the safety of the muscle, tendons, or ligaments, the brain sends a reflexive signal to the stretching muscle to contract and recoil in defense.

One final point important to note is that the stretch reflex is not only used during stretching to protect from over-stretching but is also a valuable training tool. Muscle spindles activate the stretch reflex during the eccentric phase of training (like the lowering phase of a squat) during plyometric exercises to increase muscle force output.

Apply active recovery techniques to your client's program—sign up for **ISSA's Yoga Instructor Course**. Prepare to learn the benefits that yoga provides and the tools you can use to effectively implement it.

UNIT THREE

Sleep and Meditation

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Sleep

Exercise is vital to maintaining healthy sleep habits. The positive effect of exercise on sleep is widely recognized; however, it is also true that sleep plays a vital role in exercise performance outcomes. Sleep is defined as a period of rest for the body and mind. It is characterized by stable posture and the absence of responses to stimuli.

SLEEP VERSUS REST

Sleep is different than rest. Rest can occur during training and be something as short as a 5- to 10-second intra-set rest break, whereas sleep is ideally 7 to 9 hours long. During sleep, recovery is near maximal, especially if sleep is paired with adequate rest periods between training sessions like the 48-hour rest recommendation following high-intensity training (anything above 85% maximum intensity).

BRAIN HEALTH

Sleep plays an important role in the maintenance of proper brain functioning. One of the primary ways in which sleep facilitates cognitive health is that during sleep, new brain pathways are formed that result in new ways to process information. Adequate sleep has also been associated with improvements in memory and learning, increased attention and creativity, and better decision-making.

HORMONES

During sleep, Human Growth Hormone (HGH) is released, with 75% of that being released during the first hour of sleep (Jakob, 2010); therefore, it would stand to reason that a nap at least one hour in length would facilitate the release of HGH. HGH is essential to maximizing exercise outcomes as it plays a key role in bone and muscle development, regulating protein synthesis, and increasing fat utilization. HGH helps to maintain healthy body composition by reducing body fat and increasing lean mass, and adequate sleep is necessary for HGH to be released into the bloodstream for use.

Testosterone is released during sleep; however, for levels to reach their peak, men need to be asleep for at least three hours. In the absence of sleep, testosterone levels decrease which can facilitate aging, and if the decrement is prolonged, can lead to decreased muscle performance.

Too little sleep, defined as less than six hours for most people, interferes with proper glucose regulation which can, in turn, contribute to the development of diabetes (Kim, 2018). During sleep, insulin is released and regulated. When people do not get enough sleep, insulin behavior may be adversely affected and could cause some people to be more likely to develop insulin resistance or type II diabetes during their lifetime (Ambardekar, 2019).

SLEEP PRESCRIPTION

For most adults, the standard recommendation is 7–9 hours of sleep per night; however, this may vary by individual preferences and needs along with activity levels. Women may need more sleep than men; the prescribed eight hours, while men may be able to get away with less. Serious recreational and competitive athletes may need up to 10 hours of sleep per night dependent upon training demands.

SLEEP DEPRIVATION AND IMMUNE HEALTH

In one review (Mullington, 2010), researchers examined the results of previously done studies on the loss of sleep and inflammation, an indicator that the immune system is working. What they found was that as little as a 25%–50% reduction in a typical eight-hour night's sleep can cause an inflammatory response, a reaction to a perceived threat that can negatively affect the immune system. As quickly as one night's poor sleep can begin to deleteriously affect health. Prolonged sleep restriction can lead to an increase in the levels of inflammatory mediators, molecules that play a role in inflammation that represent the possible development of such things as a metabolic disease like Type II diabetes and other serious conditions like heart disease.

EFFECTS OF EXERCISE ON SLEEP

Although moderate exercise impacts sleep positively, when over 1,600 studies were analyzed to determine the quality of sleep among athletes, athletes were shown to have longer sleep latencies, increased sleep fragmentation, non-restorative sleep, and excessive daytime fatigue. Athletes and people that consistently train at high intensities (anything over 85% maximum intensity) are vulnerable to sleep disturbances (Gupta, 2017).

Meditation

Meditation is defined as a deliberate event where an individual practices mindfulness. During meditation, the goal is to focus the mind on a particular object, thought, or activity with the intent to practice attention and awareness and ultimately achieve a clear mental state and emotionally calm and stable state.

Meditation is relevant to exercisers because exercise itself stresses the body and mind in a variety of ways. Therefore, meditation after exercise can be especially valuable, but it is often overlooked as a rest and recovery tool.

Cortisol is a stress hormone released into the bloodstream during exercise. It helps to facilitate work and its primary evolutionary role was to shut down unnecessary bodily functions during an emergency. For example, if someone is running from a threat, cortisol releases and suppresses non-critical functions like the immune system. With that in mind, increased levels of cortisol over a long period negatively impact health.

Meditation immediately after exercise reduces cortisol levels. Deep respiration activates the vagus nerve which triggers the nervous system to slow heart rate, lower blood pressure, and decreases cortisol.

Meditation doesn't have to be a prolonged event or even planned. Something as simple as sitting quietly after a workout for a few minutes and actively paying attention to a few breaths can yield the positive benefits associated with meditation. Mediation is also effective on full rest days and at any time during the day or night when stress occurs and cortisol is released.

If sitting still is not conducive to relaxation, try holding gentle stretching poses:

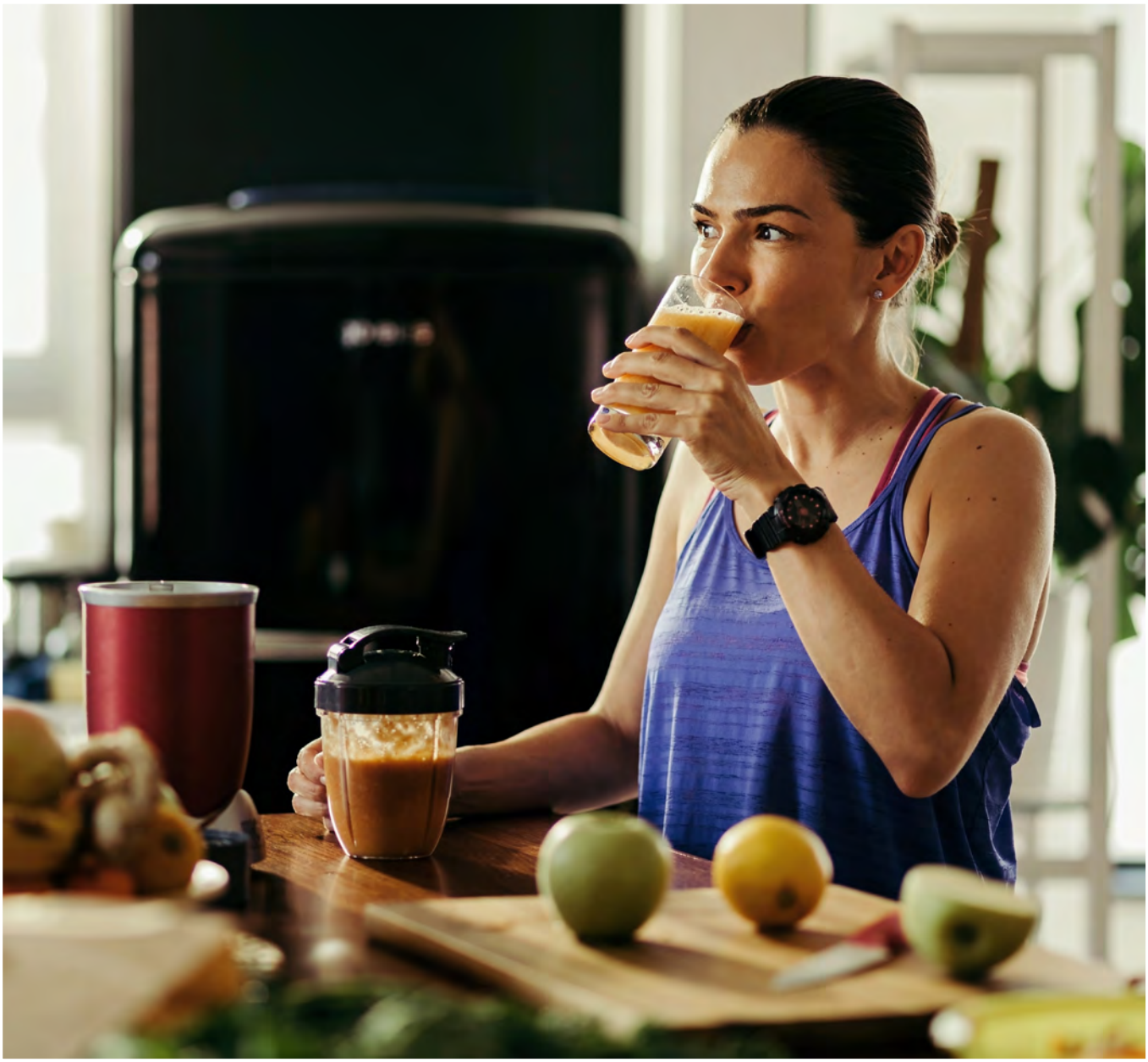
- Side bends in a cross-legged position
- Child's pose
- Downward facing dog
- Seated forward fold
- Supine knee-to-chest
- Supine spinal twist
- Any other position that promotes a general feeling of well-being

Regardless of body positioning, the key is to focus on controlled, prolonged breathing.

If this area of study interests you, the ISSA offers certification as a **Certified Yoga Instructor**. This program teaches you how to create a fitness program and teach classes that help people become stronger in their mind-body connection through spiritual sessions of physical activity.

UNIT FOUR

Nutrition



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What To Eat

You may have heard of the ideal macronutrient percentages or combinations such as 40-30-30 or 60-20-20. These refer to the "perfect percentages" of carbohydrates, proteins, and fats one should consume throughout the day for better performance. The truth is, not all macronutrient combinations are created equal and there is no "magical" one-size-fits-all percentage or ratio.

Insulin is one of the most anabolic hormones there is, when manipulated correctly. To best understand how insulin works in the body, understand these key points:

- Food consists of three macronutrients—carbohydrate, protein, and fat. When we eat carbohydrates, they first go to the stomach where they are digested and then proceed to the intestines where they are absorbed into the bloodstream in the form of glucose (blood sugar or blood glucose). As blood glucose levels rise, the body secretes insulin, a hormone that is responsible for storing glucose (in the form of glycogen) in muscle and organ cells.
- Normal blood glucose levels range between 80 and 120 mg/dl. When blood glucose levels fall below 80mg/dl, we feel hungry and the metabolism naturally slows.
- When our blood glucose levels rise above 120 mg/dl causing an insulin secretion and all the muscle cells and organ cells have been filled, the residual glucose is stored as fat. The practice of maintaining normal blood glucose levels will have the secondary benefit of helping to avoid food cravings and overeating.
- The type of carbohydrates consumed is important since the more quickly carbohydrates leave the stomach, the faster blood glucose levels rise. Usually, the faster blood glucose levels rise, the more effectively glucose gets stored as fat due to larger insulin secretions. These large insulin secretions then cause a quick drop in blood glucose levels, causing us to get hunger pangs and/or cravings; further highlighting the importance of blood glucose control.
- Gastric emptying time studies show that the longest time that carbohydrates will stay in the stomach is one hour. In contrast, protein will stay in the stomach two hours, and fats will stay in the stomach three to five hours. Studies found that when a protein is combined with a carbohydrate, both the protein and the fat within the protein source cause the carbohydrate to stay in the stomach longer (approximately three and a half to four hours) and delay gastric emptying.

There is no perfect combination of macronutrients that applies to everyone as everyone's genetic code is unique. Your unique DNA holds the key to what truly is the perfect macronutrient recommendation, and it comes down to Nutrigenomics.

Nutrigenomics is the study of the effects of food and food constituents have on gene expression, and how genetic variations affect the nutritional environment. In simple terms, our genes and gene variations/expressions, just as they determine the color of our eyes, our height, etc., also determine the right percentage of carbohydrates, protein, and fats that lead to better absorption and utilization of nutrients. The DNA-based range is known as the Nutrigenomic–Macronutrient Percentage.

Having your DNA tested is as simple as taking a cheek swab and sending it into a lab to be tested. Within a few weeks, the results are received and your DNA specific macronutrient utilizations will be revealed. With Nutrigenomic Macronutrient Percentages in hand, they can be applied to the nutrition philosophy of your choice.

Want to learn more about DNA-Based Fitness and provide this ground-breaking service to your clients? Check out the **ISSA DNA-Based Fitness Coach** specialization for everything you'll need!

Our unique genetic code also reveals the exact percentage of resistance and endurance exercise our workouts should consist of to get the best results possible from the time invested in training. That highly specific and tailored exercise routine, when combined with a custom DNA-based nutrition program, will yield faster, better results than anything else you may have tried in the past. As an added benefit, it will give you the peace of mind of knowing that you are no longer playing a guessing game with what may or may not work for you and your clients.

When To Eat

When combined with protein, and/or fat (as well as fiber), gastric emptying time of carbohydrates changes—it increases. When gastric emptying time increases, blood glucose levels do not rise and fall as quickly as when the same amount of carbohydrates are consumed by themselves and blood glucose levels are maintained within the normal range longer.

With this knowledge in hand, it becomes clear that pre-workout meals should be a combination of complex carbohydrates combined with a low-fat protein source and some fibrous, non-starchy carbohydrates; all designed to provide you with a steady amount of glucose and sustained energy for a training session.

COMPLEX CARBOHYDRATES	LOW FAT PROTEIN	FIBROUS, NON-STARCHY CARBOHYDRATES
Brown Rice	Chicken Breast	Raw or Steamed Broccoli
Sweet Potatoes	Filet Mignon	Cauliflower
Quinoa	Bison	Artichoke Hearts
Whole Grain Breads	Ostrich	Cruciferous Vegetables

This meal should be consumed at least two to three hours prior to a workout so that proper digestion can take place. The stomach is a muscle and it requires blood to perform its functions. If you were to eat a meal and exercise immediately, depending on the intensity of your exercise, the blood that has been sent to the stomach and surrounding mesentery would be diverted to your extremities.

During exercise, five hormones that convert glycogen into glucose are secreted:

- HGH
- Epinephrine
- Norepinephrine
- Glucagon
- Cortisol

Key takeaways from this knowledge are as follows:

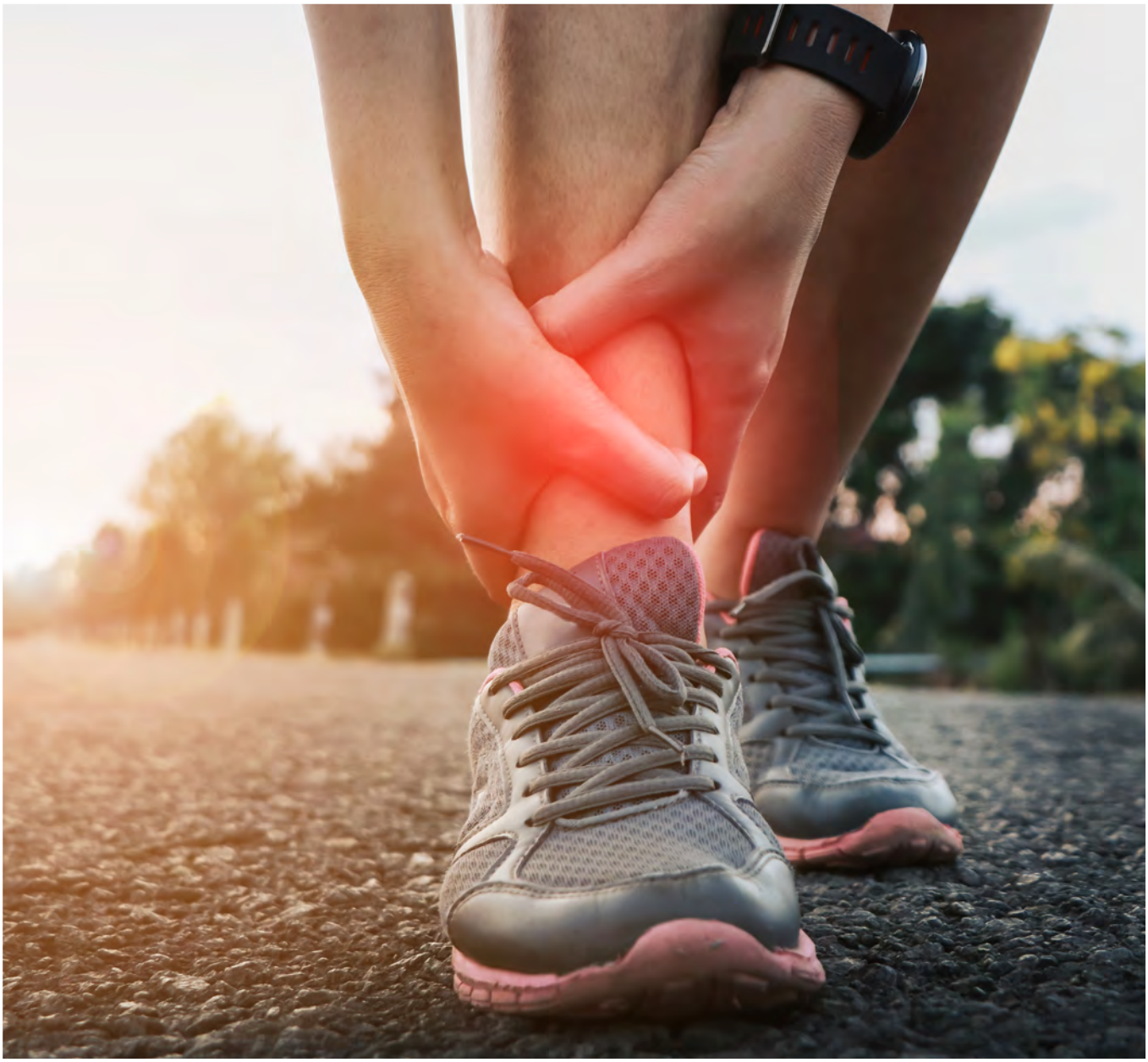
1. Avoid foods with high levels of sugar before exercise as this would elevate your blood glucose levels, cause insulin to be secreted, and promote the storage of sugars instead of being used to fuel physical activity. This includes sports drinks.
2. These five hormones counteract with insulin. This means that they cannot exist in high amounts at the same time. These hormone levels drop approximately ten to fifteen minutes after exercise.

To maximize recovery, repair, and growth, the strategy is to wait 15 to 20 minutes after your workout to drink a post-workout shake. Your post-workout shake should consist of a specific type of carbohydrate to act as the driver and shuttle into glycogen depleted muscle cells everything else we want to include in the post-workout shake. These specific types of carbohydrates are referred to as “fast-acting carbohydrates” or “fast starches” and the main players are dextrose, maltodextrin, and waxy maize. These fast-acting/fast-absorbing carbohydrates, when consumed 20 minutes post-workout, lead to much greater glycogen storage due to the five insulin blocking hormone levels have diminished. In addition to the fast-acting carbohydrates, the post-workout shake should also include the following:

- BCAAs (branched chain amino acids) - prevent muscle wasting and soreness
- L-Glutamine - supports fat loss and decreases muscle wasting
- 100% hydrolyzed whey protein - breaks down easily for fast cellular transport
- Creatine monohydrate - enhances muscle building and repair
- Vitamin C - protection from free radicals
- Vitamin E - protection from free radicals

UNIT FIVE

Overtraining



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One of the prime reasons athletes and soldiers are generally younger individuals is they can exert at high levels, not get injured, and recover quickly. Interestingly, the scheduling of major sports events is based around the recovery needed by the athletes. Football players require roughly a week, basketball players a day or two, and baseball players only need about one day, except for pitchers who need longer.

What are some critical questions to ask in determining recovery time?
What is the age and gender of the individual?
What is the training status of that person? Unfit, Fit, Highly Fit, Elite.
What has been the past "volume" of training and overall load?
Are there seasonal fluctuations or championships; periodization?
What past or current injuries has the individual sustained and what is the likelihood of reinjury?
How could these injuries result in compensation somewhere else in the body?
What is the stress load of this person, outside of the physical exercises?
What is the nutritional regimen, or supplement regime?
What recovery modalities are currently being utilized? Massage, stretching, rolling. Jacuzzi etc.
How much sleep is the individual getting? Is this normal?

There are five types of training; however, there are four types of overload on a continuum from low to high.

Acute overload would be a typical workout with moderate to high intensity or duration but not both. Recovery time is typically 24-48 hours prior to another (overload) day. This first stage is training with lower volumes and intensity and many call this level "active recovery."

Functional overreaching would be pushing the edge of the envelope so to speak. It can be tolerated every so often but not frequently. Many trainers will throw in a week of this to break plateaus or induce some higher intensities or power.

Nonfunctional overreaching is lower level overtraining syndrome, where recovery can occur, but it will take additional time above functional overreaching.

Overtraining syndrome implies both physical and psychological issues have been sustained, and recovery back to optimal performance may take several weeks (see Signs of Overtraining).

There are many factors that can be expressed in different individuals when they are overtrained or under-recovered. There can be a loss of strength and coordination, a reduced exercise capacity and constant fatigue, a change in appetite and loss of body weight, irritability, excitability, anxiousness, and sleep disturbances or restlessness. A loss of motivation, vigor, and burnout potentially leading to a lack of mental concentration and depression. Interestingly, clinical depression has many of these same symptoms, leading experts to believe there are common physiological mechanisms behind each. These can be divided into 4 categories:

- Performance
- Physiology
- Psychological
- Biochemical

SIGNS OF OVERTRAINING			
Performance	**Physiology**	**Psychological**	**Biochemical**
• Training tolerance • Recovery time • Motor coordination • Technical faults	• Altered resting HR, BP, respiration • Body fat and weight • Lactate response • VO2, VE, and HR-submax level • BMR • Chronic fatigue • Sleep disorders • Menstrual disruptions • Headaches, GI distress • Muscle soreness and damage • Joint aches & pains	• Depression and apathy • Self-esteem • Ability to concentrate • Self-efficacy • Immunological stress • Illness occurrence • Rate of healing • Immune function	• Hypothalamic Dysfunction • Serum cortisol and Sex Horm Bind Glob • Total/free testosterone • Testosterone/cortisol ratio • Muscle glycogen • Serum Hb, Fe, and ferritin • Negative N2 balance

Interestingly, many of the symptoms of clinical depression mimic the overtraining syndrome. Some experts believe it is a protective mechanism of the body to prevent further harm (Kajaia, Maskhulia, Chelidze et al, 2017).

Resistance Training and Overtraining

Like the many reasons for exercising there are reasons for lifting. The FITT (Frequency, Intensity, Time, Type) principle applies to lifting as well. The main types of lifting wall into four main categories: maximal effort (strength), submaximal effort (hypertrophy), dynamic effort (speed and power), and repeated effort (endurance).

Similar to endurance exercise, resistance training can be measured or gauged by lifting variables within a workout and across workouts. Within a workout the frequency represents the repetitions in a given set, the intensity is the weight lifted or level of resistance, the time or duration is the number of sets, and the type is speed of movement or even no movement. Lifting tempo is often described in concentric, isometric, and eccentric muscle action.

When most athletes train, they need to replicate the type of contraction that will improve their performance on the field the most. Having power, or the ability to move a given load at a given speed, is critical in most sports. When one trains to move slowly as in slow tempo resistance training, the motor patterns to move fast are not utilized which results in enhancing the slow patterned movement. In addition, some orthopedists found joint issues were starting to occur in those practicing slow sustained weight training styles.

When performing an eccentric contraction, you are shortening the muscle but increasing the joint angle or lengthening the tendon. While this puts very high stress on the muscle and potentially builds it, the risk of a tendon-pull or microtrauma to the muscle is very high. Plyometrics uses this training phenomena to enhance tendon strength and neural reactivity. It is also associated with injury when performed too often.

Overtraining and the Immune System

Exercise is a stress. Some stresses can be good for the body and mind, which are known as eustress. Too much of even a good stress is not good. The body reacts to stress in two main ways, First, the autonomic nervous system is activated and it sends a signal to the adrenal medulla to release epinephrine and norepinephrine, and the adrenal cortex is activated to release corticosteroids, such as cortisol. The hypothalamus in the brain is also activated, which then stimulates the anterior pituitary gland, which then also activates the adrenal gland to do the same. While cortisol is great to have in times of stress, a chronically high level is not good. As a result of hypercortisolemia (high cortisol in the blood), inflammatory factors are released and certain substances called cytokines will suppress the immune system functions and thus increase disease susceptibility. An early warning is a sore throat, known as an upper respiratory tract infection, and slight fever and achiness. In addition, the enteric nervous system or nervous system in the gut will also be affected and cause digestive issues and affect the gut microbiome which further reduces the immune function and positive mental state.

If a client is getting sick more often than normal or feeling the onset of a cold or flu, they should likely back off training until recovered. When sickness is present, OTS is often not far behind. So, listen to the mind and body!

UNIT SIX

Recovery Strategies

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The Physiology of Recovery

To understand how the body recovers from exercise it is important to understand how the physiological systems respond to exercise. The specificity of exercise states that the adaptation of the body is specific to the type of training. This specificity also holds for recovery. It has been shown that individuals with a higher VO2 max can recover more quickly and replenish creatine phosphate stores. The muscular system recovers primarily after we complete our exercise and is characterized by the removal of lactate and hydrogen ions. Other factors of recovery involve a return to normal respiration, blood circulation, and body temperature.

METABOLIC CHANGES

Adenosine triphosphate (ATP) is the immediate source of energy for skeletal muscle. There are three main pathways that the body uses to restore ATP—the phosphagen system, glycolysis, and mitochondrial respiration. Following high-intensity training, lactate and hydrogen ion concentrations increase within the muscle. Because most high-intensity exercise is performed above the lactate threshold (when lactate begins to accumulate), most high-intensity exercise requires recovery periods.

Increases in lactate and hydrogen ion concentrations have been found to interfere with muscle contraction function and have been shown to contribute to levels of fatigue. It would appear that a well-developed aerobic and anaerobic system combined with a well-designed recovery strategy will help enhance the removal of blood lactate.

HYDRATION AND GLYCOGEN REPRODUCTION

It is the body's fluid level, primarily water, that is critical to the recovery of the cardiovascular system. As the body loses fluid through the heat generated by exercise, the body will correspondingly reduce the volume of fluid in the blood plasma, which interferes with the ability of the blood vessels to transport oxygen, minerals, and other nutrients throughout the body.

If glycogen stores are not restored before the next bout of exercise, performance will suffer. The restoration of depleted energy stores will begin the moment that carbohydrates are consumed after the activity. A return to the athlete's usual level of carbohydrates is a process that depends on the carbohydrates present in the foods consumed and the level of physical activity in the rest period.

EXERCISE-INDUCED MUSCLE DAMAGE

Muscle damage is commonly caused by strenuous or unaccustomed exercise. Microtears in muscle tissue are created during resistance training and can take several days to repair. The resulting inflammation has been found to be beneficial as it is a physiological indicator that the body is healing. Sore muscles and joints are generally indicative of proper muscle repair after training sessions. Prolonged soreness beyond delayed onset can indicate injury.

Recovery Modalities

There is a wide variety of modalities that have been developed and are being used as important parts of training programs to enhance recovery. Most of these modalities have been studied to evaluate how they influence the rate of blood lactate removal and reduce DOMS following a bout of high-intensity exercise. While there are many options available, no one method has been found to be the best option for all individuals.

CRYOTHERAPY

Cryotherapy is a therapeutic intervention using cold therapy with the intent to speed recovery between intense bouts of exercise or competition stress to maintain performance level. Cold therapy may include but is not limited to ice packs, cold showers, ice ingestion, cryotherapy chambers, cold water immersion (CWI), and contrast water therapy (CWT) to stimulate beneficial effects, being reduced pain, reduced inflammation, and reduced muscle soreness. Whole-body cryotherapy (WBC) is a brief exposure in minimal clothing to very dry cold air (usually between -100 to -140° Celsius, (-148 to -220° F) for 2-5 minutes. The initial response to cold therapy is vasoconstriction, which causes the conservation of blood flow to the core. Subsequently, after cold therapy, there is a reversal of vasoconstriction, resulting in vasodilation which can stimulate increased blood flow to the tissues theoretically allowing for improved metabolism, oxygen supply, and waste removal. There is also an analgesic (pain reducing) effect in which reduced nerve excitability results in decreased nociceptor stimulation.

COMPRESSION

Compression has been used in medicine for many years for prevention against deep vein thrombosis (DVT), pulmonary embolism risk, and managing lymphedema. Compression garments have become extremely popular and are widely used by both professional and recreational athletes. Compression therapies aim to promote optimal blood and lymph circulation throughout the body.

FOAM ROLLERS

There are various types of devices including the traditional foam roller, roller massage bars/sticks, vibrating rollers which all come in several sizes and foam densities. Foam rollers work to reduce tissue adhesions, altered tissue stiffness, and improve tissue viscoelasticity and range of motion and flexibility.

Foam rolling is a technique that requires the individual to use their body weight to apply pressure to the soft tissue. One of the theories that have been proposed is that this form of self-myofascial release may have an effect on the Golgi tendon organ (GTO) which is a mechanoreceptor sensitive to changes in muscle tension. The GTO is protective and stimulates muscle spindles to relax when there is a risk for tendon rupture. This is referred to as an autogenic inhibition, preventing muscles from exerting more force than the bones and tendons can tolerate.

VIBRATION

Whole-body vibration (WBV) is used to improve strength in sedentary individuals or recover from the effects of strenuous exercise. The therapy claims to improve circulation, increase muscle temperature, improve ROM, performance, and relieve common muscle pain. There are two types of vibration therapies, local vibration (LV) to muscles and tendon administered by handheld devices and WBV performed by vibrating plates. The method of application may influence the amplitude and frequency that is delivered to the muscle and the training effect. With LV the amplitude and frequency do not differ significantly to the applied muscle as opposed to WBV in which the soft tissue can dissipate the desired effects to the targeted muscle(s).

It has also been theorized that WBV triggers the tonic vibration reflex increasing muscle spindle activity which makes the muscles firing threshold easier. When this happens a greater number of muscle fibers would be used which may reduce the stress during muscle contractions and lead to improved recovery. The ideal frequency to elicit an effective muscle contraction has been determined to between 30-50 Hz.

MAXIMIZE RECOVERY, MAXIMIZE RESULTS

Building a well-rounded fitness routine is important for your overall health and fitness and something you should impress upon clients. Rest and recovery are just as important as the workout because nothing ruins progress faster than burnout or an injury from overtraining.