NFPT CEC Self-Test Packet

The Air Pressure is On
Running Against the Barometer

Oxidative Stress:
Fighting Free Radical Damage

WHAT PERSONAL TRAINING STYLE GETS THE BEST RESULTS?

BIANNUAL EDITION: June 2021
Continuing Education Articles for Personal Trainers
from www.nfpt.com/blog

National Federation of Professional Trainers

NFPT SELF - TEST

JUNE 2021 EDITION

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NOTE: there are articles in this packet which contain links and/or references to resources and information only available online. Go to: www.nfpt.com/blog/cec for these additional resources.

We thank you for your commitment to the fitness industry and to the NFPT organization of trainers. Please contact us at 800-729-6378 or at info@nfpt.com with any questions, or to just be in touch. *We wish you continued success in your endeavors!*

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Menopause and Exercise: Training the Challenge

Menopause defines the time frame following a year-long cessation of a woman's menstrual cycle. *Perimenopause*, not nearly as easy to recognize, refers to the few years leading up to menopause, when the female body begins to experience hormonal flux and accompanying symptoms. Helping to navigate this stage with appropriate exercise can make a significant difference in a female client's quality of older life.

Personal trainers whose client base includes more than just robust individuals in their 30's and 40's have no doubt noticed an increase in middle-aged and older women choosing to exercise. Often living well into their 80's, our female population continues to grow. As trainers work with menopausal women, understanding the physiological changes experienced during this "third stage of life" can ensure more successful exercise experiences.

Easing the Transition of Menopause

When bodily changes naturally occur with age, many women settle into a routine of sedentary complacency, inviting the risk of more serious health problems. Maintaining or embarking on an appropriate exercise regimen at this time can go a long way towards staving off many of the more common menopausal complaints.

- **Midsection Weight Gains ~**Aging women observe an increase in adipose tissue, typically around their abdomens. The body pulls adipose in to protect internal organs, which may thicken the midsection. Regular physical activity can help mitigate this, which in turn diminishes risks of Type 2 diabetes and heart disease. An increased distribution of lean muscle mass along with a healthy weight may also confer some protection against breast and endometrial cancers.
- **Weakening of bones ~**Exercise, especially resistance training, can help with the bone loss accompanying menopause and older age. Improved bone density, coupled with increased flexibility and balance, significantly lowers the risk of fractures, osteopenia, and osteoporosis.
- **Anxiety and depression ~** Women who remain physically active into their older years tend to experience less anxiety, depression, and cognitive decline.

Continuing Activity

Regardless of one's stage of life, exercise parameters for women remain the same as always. An ideal exercise prescription from the *Department of Health and Human Ser*vices combines aerobic activity, performed moderately for a total of 2 ½ hours/week; balance exercises; flexibility movements; and resistance training. Especially in the years when circulating estrogen wanes, this program helps women maintain or even increase bone density, lean muscle tissue, and overall strength.

Bone Loss and Menopause

Personal trainers working with clientele in the perimenopausal or menopausal stages of life may have also observed an increased presence of osteopenia or osteoporosis, a common artifact of diminished estrogen. Addressing bone loss concerns can help identify which exercises remain appropriate and which to avoid, namely higher-impact aerobics.

Even a carefully structured balance program may result in falls. Teaching clients to perform these moves alongside a stable surface should help allay fears about potential tumbles. If a client's bone loss lies in or near

her spine, pay close attention to moves requiring trunk flexion, with or without resistance, as these can predispose one to spinal fractures.

Addressing Anxiety

Menopause seems to trigger anxiety among many females who have grown accustomed to their bodies' performance for the past 40+ years. Suddenly, a restful night's sleep seems elusive, anxiety replaces body acceptance, and often depression creeps into daily life. Couple all of this with intermittent cognitive lapses, and many women see a recipe for potential emotional upheaval. At this point, along with the aforementioned modes of exercise, stress release through yoga, stretching, and mind-body sessions can help offset menopause-related anxiety as well as many of the more commonly experienced symptoms.

Helping Hot Flashes

The topics of hot flashes and night sweats inevitably arise as part of any discussion among menopausal women. Scientists believe the phenomenon stems from an aberration in the body's thermoregulation system. One study delved into the fact that during the perimenopause years, individuals tend to exhibit a lack or complete absence of both sweating and shivering.

New research points in the direction of exercise as a means of improving the body's ability to properly dissipate heat. Over time, regular moderate aerobic exercise can shift the body's sensitivity to sweating, reduce core temperature, and potentially trim the frequency of hot flashes by 50% or more.

Estrogen and the Athlete

Female athletes are not exempt from the transition into menopause and its accompanying physical changes. In fact, *overtraining* can actually work to the client's detriment by signaling excess cortisol, the key culprit of belly fat storage. Along with diminishing levels of estrogen, a reduction of testosterone levels also defines the menopausal years, threatening to dismantle hard-earned strength and muscular power.

If clients observe these changes, try incorporating some HIIT such as plyometrics into their training sessions, along with gradual increases in strength training. Fewer *hard-core* endurance sessions (such as distance running or back-to-back low weight/high rep sets) can aid in the hormone/cortisol balance.

Kegels are Key

Another frustrating aspect of the female body, often evidenced post-partum but exacerbated as we age, involves the muscles of the pelvic floor. Urinary incontinence reportedly affects nearly half of all menopausal women. While many individuals feel that this condition simply accompanies "old age", science points rather to the more sedentary lifestyle into which many older Americans settle. Decreased circulating estrogen can predispose menopausal women to pelvic floor muscle weakness, most notably those muscles controlling the excretion of urine.

Kegel exercises work the pelvic floor muscles, thereby offsetting incontinence. By tightening and releasing specific muscles, an isometric-type contraction strengthens the pelvic area. While some male trainers may find it awkward to discuss this with older female clients, and even more challenging to describe the exercises' execution, the simple approach works best.

Instruct clients to think about waiting in a long line for the women's bathroom… after several cups of coffee. The simple act of "holding it in" can work those Kegel muscles and help prevent accidental leakage. Women can easily perform these exercises several times each day…with nobody around them even knowing!

Rolling with the Changes

Those of us fortunate enough to embrace our older years can expect bodily changes, regardless of healthy and active lifestyles. Trainers can help clients commit to adding movement into their daily routines. Setting small goals, rather than long-term hefty aspirations, helps create a sense of accomplishment. As the partnership continues into clients' elder years, gently increase challenges to eliminate plateaus or complacency. The human body, simply a machine after all, requires ongoing maintenance to prevent as many problems as possible.

Training Through Heel Pain

It is not uncommon for clients to come to us with pre-existing injuries, or to experience pain or discomfort at some point. Generally speaking, injuries will require time to rest and recover, but this doesn't always mean taking a break from training entirely. In the case of plantar fasciopathy, a common injury affecting 1 in 10 people in their lifetime, there are still many ways to continue training through the heel pain and maintain fitness while recovering.

While it is not our job to diagnose or treat, it is within our scope of practice to provide encouragement and support for our clients as they recover.

The Injury: Plantar Fasciopathy

Heel and foot pain affects individuals of all ages and fitness levels. The umbrella term for this injury is *plantar fasciopathy*, though most clients will be more familiar with *plantar fasciitis*. Plantar fasciitis involves inflammation of the plantar fascia and it commonly causes a stabbing pain, usually when taking the first steps upon waking. If left untreated, the injury can become chronic and lead to degeneration of the plantar fascia, *plantar fasciosis*.

No matter what we call it, this injury is painful and it may be challenging to get motivated to exercise.

For clients dealing with plantar fasciopathy, we may be able to provide guidance and targeted exercises for relieving pain. But aside from these injury-specific exercises, what sort of training is appropriate and beneficial to maintain fitness while recovering?

Training through Heel Pain: Cardio

For clients who love to get their heart rate up with sprints and plyometrics, a plantar fasciopathy diagnosis could be especially frustrating. It's possible that the injury was sustained because of this exercise- it affects 8% of running-based athletes- but, regardless, it is likely to exacerbate the pain and prolong recovery.

Fortunately, there are many options to get a client's heart rate up without repetitive strain and impact on the inflamed or degenerated plantar fascia.

1. **Hand Cycle**
   The hand cycle puts no impact on the feet, and can still get the heart rate up by working the muscles of the upper body. This could be a great option in cases of plantar fasciitis where there is active inflammation.
2. **Stationary Cycle**
   Because this doesn't put full body weight on the feet, riding a stationary bike is a great option for cardio and leg strengthening while recovering from plantar fasciopathy.
3. **Rowing**
   Actual rowing in a boat or kayaking is an option if it's available where you live, but most gyms will have rowing machines that are a great, easy-on-the-feet way to work out with plantar pain.
4. **Elliptical**
   While the elliptical is a lower-impact alternative to running on the treadmill, it may still cause foot or heel pain. This could be the last step to check in before returning to running or after pain has subsided.

Training through Heel Pain: Strength Training

For someone who has been incorporating strength training into their workouts, the solution may seem obvious to avoid heel pain: only work the upper body. While it's true that upper body strengthening exercises remain an option while recovering from plantar fasciopathy, it does not mean lower body exercises should be avoided. In fact, **high load strength training can lead to a quicker reduction in pain and improvement in function**.

Seated machines are a great place to start as they take the load off of the feet, but slowly and progressively adding load to the plantar fascia can improve tissue capacity.

1. **Leg Curl**
   It can be helpful to work the hamstrings as they share a fascial connection with the plantar surface of the foot. Using a leg curl machine can help strengthen the hamstrings without weight bearing on the feet.
2. **Leg Extension**
   Much like the leg curl, leg extensions are a great exercise to incorporate early in the recovery process since it can keep your clients off of their feet.
3. **Hip Abduction/Adduction**
   Since the hip muscles play an important role in the biomechanics of the lower limbs, hip strengthening exercises should be incorporated. Specifically, weakness in the hip abductor muscles can contribute to heel pain so strengthening these muscles can optimize management of plantar fasciopathy.
4. **Calf Raises**
   Eccentric calf raises can improve the outcome of treating plantar fasciopathy and thus can be included in strength training. A slow progression is key here and studies suggest progressing every second week.

Managing an injury can be challenging, but maintaining fitness will ensure our clients can stay on track with their goals and remind them that, with the right mindset, nothing is a setback.

BCAAs: A Paradoxical Effect on Metabolism

Can a diet rich in Branched-Chain Amino Acids, or BCAAs, provide benefit *or* inflict harm with regard to stabilizing insulin levels? If the answer is the latter, would that place BCAAs in the category of "causative agents" or simply "red flag portents" of insulin resistance? While the research indicates that BCAAs improve metabolic health overall, excessive amounts in plasma levels align with an elevated risk of both metabolic disorder and Type 2 diabetes.

Protein Breakdown and Synthesis

Muscle protein undergoes constant change through the processes of protein turnover. Athletes achieve hypertrophy when synthesis exceeds breakdown; when the opposite occurs, we see muscle wasting and catabolism. Although acute effects of exercise are catabolic, exercise clearly does not cause muscle wasting; instead, regular exercise is essential to optimize muscle growth and hypertrophy.

During exercise, **muscle protein synthesis decreases as protein degradation increases**. As one proceeds through a workout, **a notable reduction in the amount of circulating branched-chain amino acids takes place.** In order to return the body to a positive nitrogen balance and allow hypertrophy to occur through muscle protein synthesis, the body demands *nutritional restoration.*

Leucine as the BCAA Lone Star

Both exhaustive endurance exercise and resistance training inhibit muscle protein synthesis in direct correlation to the intensity and duration of the activity. At the end of such workouts, protein synthesis increases with appropriate nutritional intake (restoration of a positive nitrogen balance). The molecular mechanisms leading to protein synthesis under these conditions place **leucine** in a central role.

We have learned that the characteristics of a quality protein source include not only prompt digestion and transport to muscle tissues but also its leucine content. Whether in the form of real food or a BCAA supplement powder, capsule, etc.), the hard-working athletic body requires a sufficient amount of leucine in order to re-establish the aforementioned positive nitrogen balance. Unlike most amino acids, which are processed in the liver, BCAAs are primarily metabolized within muscle tissue. This optimal evolutionary feat fosters quick absorption, providing the necessary post-exercise fuel.

More Isn't Better

When seeking advice from personal trainers, clients may express a preference for consuming a protein shake loaded with ample BCAAs than a small meal post-workout. As long as adequate leucine makes an appearance, the method of delivery – food versus liquid – matters very little.

Consuming a safe amount of BCAAs has proven effective in helping athletes retain muscle mass. During a period of reduced calories, such as the "cutting phase" bodybuilders undergo when preparing for the stage, BCAAs can also help to maximize fat loss.

However, as with any substance, overconsumption of BCAAs can induce negative side effects. Among the most commonly reported complaints– fatigue, loss of coordination, nausea, and headaches –*increased insulin resistance* tops the list as an almost sure-fire recipe for developing obesity, Type 2 diabetes, and/or metabolic syndrome.

The Role of Exercise

People living with Type 2 diabetes and/or metabolic syndrome are often categorized as obese as well. Obesity itself can easily pave the way to insulin sensitivity. While personal trainers need to exhibit additional caution and creativity when designing training programs and working with such clients, we know the benefits eventually manifest. Exercise propels the body to more readily eliminate excess acyl groups–detrimental substances byproducts of the metabolism of BCAAs.

It would appear that *branched-chain amino acids consumed as athletic supplementation do not in and of themselves induce insulin resistance.* Once again, exercise emerges as the driving force in this scenario, potentially enhancing mitochondrial oxidation and thereby mitigating the accumulation of the harmful catabolic intermediates referenced above. This action in turn ultimately increases circulating plasma levels of *beta-aminoisobutyric acid*, which helps to improve insulin resistance.

A Dietary Balancing Act

Scientists determined through research studies that higher levels of circulating BCAAs (leucine, isoleucine, and valine) correlated with obesity and insulin resistance in both humans and rodents. Recent discoveries in this arena seem promising, most notably how **reducing dietary levels of BCAAs boosts the metabolic health of young mice.** A simple nutritional adjustment might bring about this significant difference.

In one such study, mice consuming a diet rich in calories and sugar but lower in BCAAs than the control group demonstrated a rapid loss of fat mass. This startling result seemed to depend upon the *increase in energy expenditure* by the regulating hormone known as FGF21, or *fibroblast growth factor 21*. Given the fact that obesity now appears worldwide in epidemic proportions, FGF21 holds great potential as a therapeutic agent in treating obesity, associated metabolic disorders, and regulation of whole-body metabolism.

A spectrum of BCAAs can be obtained through these foods:

- Lean meat
- Fish
- Milk
- Cheese
- Eggs
- Quinoa
- Tofu

Leucine in particular is high in brown rice and whole-wheat foods; valine sources include mushrooms and peanuts; almonds and cashews are high in isoleucine.

Looking to the Future

Further studies point to how dietary reduction of BCAAs can elicit benefits with regard to glucose tolerance/insulin resistance. These promising results continue to underscore the important role that such nutritional adjustments can bring to the forefront of future treatments. Keeping in mind that specific dietary direction remains outside the scope of practice of most certified personal trainers, we can nonetheless remain a reliable qualitative source of unbiased information regarding the pro's and cons of BCAA use.

What Personal Training Style Gets the Best Results?

Every personal trainer has his or her own personal training style, or typical approach, taken with clients, or perhaps, each trainer takes a different approach with each client based on differing needs and expectations. So how do you know what kind of approach will work with a particular client?

Tough Love?

"Is that all you've got? Come on! PUSH HARDER!" Most of us have borne witness to these training tactics (Biggest Loser, anyone?). A client looks ready to drop, sweat oozing out of every pore, totally and clearly depleted…yet the trainer continues to yell, "You have NOT finished the set yet! You have to keep going until you pound out four more burpees!"

Such training tactics, commonly known as "tough love" is definitely not a cookie-cutter template to suit every client's needs. In terms of personal training, this training style indeed pushes a client to their limits, yet may come across as unnecessarily harsh or authoritarian to many clients.

Thriving Under Pressure

Witnessing this sort of interaction may strike the casual observer as brutal, if not cruel and or utterly unnecessary. The client may be regarded as a "victim" rather than someone who willingly paid for the trainer's services. However, upon conversing with this client afterwards in the locker room, the observer might learn that the client LOVED his workout and plans to continue working with his tyrannical trainer!

Those individuals who tolerate such training protocols report needing someone to push them, often acknowledging having made very little progress either on their own or with a kinder, gentler personal trainer. These clients view "tough love" as a kick-in-the-butt reminder of what it feels like to *work really hard*. As soon as the post-workout endorphins kick in, they can somehow pardon the yelling and harsh words.

Communication and Willing Participation

While such individuals who prefer this sort of sadistic coaching *do* exist, identifying them in advance of training is a certain a challenge. **How can a trainer possibly determine whether his or her domineering methods will work for a particular client?** Some clients will tell you right out of the gate that this is a training style they want or don't want during your very first encounter, perhaps because they've worked with trainers before and know what they need to motivate. But what about those who are new to training all together?

The answer depends to a large extent on the client-trainer relationship established along the way, and how comfortable a client feels expressing himself honestly. According to sports psychologist Jo Lukins, it does not take long for a client to know whether or not "tough love" can work for him. "If you feel it enhances your performance, then it will work well for you", she notes. Good, clear communication between trainer and client must play a primary role in such a relationship.

Lukins stresses remaining true to one's feelings. If the "tough love" training concept makes the client uncomfortable, cutting ties with the trainer preceded by a clear explanation of his feelings remains the best option for both parties.

Trainers often naively assume that everyone receives "tough love" in a positive light. Some trainers couch this under the guise of holding clients accountable for their actions. When encountering clients who complain about health issues and subpar gym performance, yet refuse to change their unhealthy behaviors, trainers feel compelled to push harder. This could come from a place of frustration on the trainer's part, or a desire to make the client work in an unreasonable manner, to convey the point of how his lifestyle thwarts his progress in the gym.

Does a "Bullying" Training Style *Actually* Work?

According to sports psychologist and executive coach Graham Jones, star athletes and business people share one defining trait: ***mental toughness.*** Champions and elite leaders in the business arena do not start their careers any more gifted than their colleagues or team members. **Rather, they have discovered within themselves how best to manage pressure, tackle obstacles to reach desired goals, and what it takes to remain one step ahead of their competition.**

Having worked with various Olympic sports stars as well as leaders in Fortune 500 companies, Jones observed a number of parallels, most notably in how such individuals have propelled themselves to the top of their fields.***Could a "tough love" training approach foster this type of excellence? Afterall, this is how many generations of yore were coached during their childhood sports experiences.***

One research study undertook the task of evaluating the influence of a trainer's interpersonal approach to her clients, recruiting over 300 athletes. The scientists specifically analyzed character traits among coaches such as providing support in conjunction with autonomy versus a more punitive, controlling style, and then looked at their effects on an athlete's resulting levels of frustration, motivation, and resilience.

It came as little surprise to discover a positive correlation with coaches offering support/autonomy with motivation and resilience; athletes trained in this fashion felt the coaches fully addressed their psychological needs as well as their sports performance. This result appeared in sharp contrast to that reported by subjects trained with a "tough love" approach.

Another similar experiment involving over 1000 athletes aimed to examine a trainer's tactics with an athlete's coping skills and emotional health. Once again, the data indicated that a more controlling training approach led to anxiety, stress, and even depression among the athletes, thereby undermining their abilities to excel. **When client-trainer interactions reflected mutual respect, athletes reported a greater sense of resiliency in the face of challenges.**

Most personal trainers do not find themselves in a position of grooming a client for the Olympic Games. However, even for the casual recreational fitness enthusiast, taking into consideration how our tactics might affect a client's emotional state during and even following a workout session goes a long way in creating a positive working relationship.

Prioritizing the Client

Having the client's best interest in mind should always remain a top priority for personal trainers; therefore, prior to implementing on a "tough love" training style, professionals should remind themselves of the **difference between the client's best interests and their own**. Very often these two ideals clash.

Trainers ought not underestimate the importance of tiptoeing into this minefield, realizing that such tactics may damage the first impression of a client new to exercise and personal training. Keep in mind that *aggression quickly turns training into bullying*, regardless of the trainer's intent to motivate. Feeling responsible for a timid client quitting the gym could create unwanted and unnecessary emotional baggage for the trainer.

Setting Unrealistic Goals

Often a trainer tells a client, "I know your muscles still ache from our last session. You need to keep working through the discomfort if you want real results!" This training style could easily backfire, setting a client up for failure or potential injury. Insisting on overly lofty goals that a client cannot possibly reach, and then chastising her for falling short, almost never turns out well for either party.

If a trainer does prefer a style of "tough love" to advance client's goals, keep the following ideals in mind:

- Clearly outline the reasons for such an approach at the beginning of the training relationship
- Find ways to adapt training techniques if the "tough love" tactic does not seem effective
- Practice what you preach…and always listen to the client's comments throughout a session

Overly abrasive and punitive training often reflects a coach taking advantage of the overall *imbalance of power between trainer and client*. A personal trainer who abuses the "tough love" platform runs the risk of crushing the spirit of the emerging athlete inside the client; a dedicated and knowledgeable personal trainer *challenges* the budding athlete inside, encouraging growth and development in a positive manner.

Always know your audience, and cater to their individual needs in the most mutually acceptable fashion. Then, watch your personal training business blossom while also keeping your clients happy and achieving their goals utilizing a training style that is most compatible with your clients.

Metabolic Confusion: Conquering the Carb-Cycling Challenge

Among many of the weight loss approaches that are conceived these days, metabolic confusion has arrived on the scene.

Metabolic adaptation refers to the means by which metabolism adapts to one's lifestyle over time. As one consumes fewer calories and burns them in exercise-induced excess, the general idea behind common "dieting", one's metabolism adapts and gets stingier with energy from calories and stored fat, doing the protective thing and slowing down what it uses in an effort to conserve the energy reserves which are starting to run low. Clients often complain that they have "hit a wall", after which further weight loss comes to a standstill regardless of their behavior.

In contrast, the *metabolic confusion* platform promotes an eating style that alternates between high and low-carb days (usually causing a variance in caloric consumption). While this plan affords the dieter more flexibility than traditional meal plans, its restrictive nature and the need for precise decision-making with regard to macronutrients poses challenges to adherence over the long haul. Can this method work for the average client?

The Physiology Behind Metabolic Confusion

Carb cycling, the fast and effective weight loss process created by nutritionist Lucy-Ann Prideaux, maximizes fat loss without deprivation of either nutrition or energy. Instead of aiming for a set number of calories each day, she prescribes carb intake increases or decreases every 2-3 days.

Proponents of the diet believe it helps "trick" the body's metabolism into working harder, resulting in fat loss. They claim that alternating between high and low-carb days will "confuse" the body's metabolic rate, making it work harder to adapt to changes in calorie intake, especially when coupled with prudent exercise.

Experts however believe we lack the true ability to "trick" our metabolism into higher gear; however, **such a cycling plan may prevent it from slowing.**

Research experiments seem to uphold the cycling premise, as in the case of the following trials run by professors in Korea. Seventy-four subjects with BMI over 25 engaged in 6 weeks of either a carb/calorie-shifting diet (CSD) or a carb/calorie-restricted diet (CR). The research protocol consisted of three 2-week phases. For individuals in the CSD group, each 14-day phase encompassed 11 days of calorie restriction over four meals every day, allowing a full 4 hours between meals. The remaining 3 days allowed the volunteers to choose their own meals. CR subjects routinely received a pre-determined, low-calorie diet.

The resulting data indicated significant weight and fat loss started and continued for at least a month of follow-up in the metabolic confusion group. During three CSD phases, subjects also witnessed a decrease in plasma glucose, total cholesterol, and triacylglycerol levels, greater than those in the CR group. In addition, subjects who engaged in calorie-shifting reported decreased hunger and overall satiety satisfaction.

The same result did not occur among those whose calories remained constantly restricted.

Carbs, Exercise, and Metabolic Confusion

Exercise leads the body to tap into its carb stores for energy; high carb days align optimally with strenuous training when the body requires a surplus of energy. On rest days or those involving lighter workouts, a reduced carb intake makes scientific sense. As the body's carb reserves approach depletion at the end of a low carb cycle, the high-carb day recharges energy and stokes the metabolism, leading to a greater fat loss.

High Carb Days: (for intense exercise)

- stimulate the insulin response, summoning nutrients into muscle tissue and promoting anabolism
- replenish glycogen stores
- provide energy

High carb days can include anywhere from 300-500+ grams per day.

Low Carb Days: (for rest days or light workouts such as a walk or hike)

- promote fat loss by burning fat for fuel
- keep your body receptive to insulin

Low carb consumption can range from 50-150 grams per day. Some variations of a carb cycling plan include a day of medium carb consumption, allowing 150-300 grams per day, during which an individual engages in regular resistance training.

Choosing Sources Wisely

Prudent complex (slow-burning) carbohydrate sources include:

Oats and other grain hot or cold cereals
Brown rice
Buckwheat
Quinoa and couscous
Sweet Potato
Rye or whole grain bread

Three macronutrients make up every food source we consume: protein, carbohydrates, and fat. While many foods contain all of these macronutrients, most skew heavily toward one or two of the three. Meat contains abundant amounts of protein and also some fats. Breads, cereals and pasta contribute mostly carbohydrates, while nuts and nut butters contribute mostly fat and just a bit of protein. The human body needs all three in some capacity to function. **The amount of protein consumed generally remains about the same for both higher and lower carbohydrate days.** Experts suggest increasing fat intake on lower carb days, as an energy substrate, while higher carb consumption requires fewer fats.

The "Head Game" Component

Devotees to metabolic confusion report eating fewer calories overall (in the form of carbs) without feeling deprived, increasing successful adherence. The key component to this plan — what doctors call a "lifestyle

change" –**requires an individual to conquer the many psychological barriers that stand in his way** of fully embracing such a major lifestyle alteration, even though the outcome justifies the means.

Given that typical carb cycling schedules require detailed and vigilant "bookkeeping" of macronutrient consumption, as well as a significant amount of time and nutrition planning, experts view it as an **intermediate to advanced nutrition strategy.** Most proponents of this meal plan include elite athletes, bodybuilders, and professional models. However, we must encourage interested clients not to abandon their desire to try this lifestyle change; it can work very well for highly-motivated amateurs.

"Adherence is the most important thing for any diet to be successful, and we know people don't stick with overly restrictive diets," says Brad Schoenfeld, Ph.D., Director of the Human Performance Lab at CUNY Lehman College in New York. "Flexible diets allow you to lose weight or have success while eating a much wider range of foods."

Proximal Hamstring Tendinopathy: A Pain in the Butt

When we think of a hamstring injury, we might picture a sprinter halting mid-sprint, grabbing the back of their thigh and wincing in pain. This is an accurate image, representing an acute hamstring injury – perhaps a strain or a tear. But hamstring injuries can present in other ways, too. More chronic injuries, like Proximal Hamstring Tendinopathy, develop over time and the pain is not necessarily where we would imagine a hamstring injury to be felt.

Proximal Hamstring Tendinopathy is commonly seen in runners, but can affect anyone, and it is described by most as its most frustrating symptom: a pain in the butt.

Hamstring Anatomy and Function

While other muscles may be considered part of the hamstring muscle group, we will look at the three true hamstrings: *semitendinosus*, *semimembranosus* and *biceps femoris*.

These muscles are located posteriorly on the thigh between the hip and the knee and they all cross and act at both the hip and the knee joints.

As primary knee flexors and secondary hip extensors, the hamstrings are involved in daily activities like walking, running, and jumping. When more demand is placed on the hamstrings, whether through running faster or longer distances, jumping as a competitive sport or weight lifting, they become prone to injury.

In the scenario above, when we imagined a runner stopping mid-sprint, the strain or tear was most likely occurring in biceps femoris, which is the most commonly injured of the three muscles.

When we thought of a client, however, complaining of a "pain in the butt", it may not be the individual muscles that are injured, but instead the tendon at its attachment on the ischial tuberosity of the pelvis.

The muscles all originate at the ischial tuberosity, or sit bone. Semitendinosus and biceps femoris share a common origin at the ischial tuberosity called the *conjoint tendon*, which is the most commonly affected hamstring tendon. The semimembranosus tendon has a separate origin, lateral to the conjoint tendon.

Proximal Hamstring Tendinopathy

Proximal Hamstring Tendinopathy (PHT), or high hamstring tendinopathy, is characterized by deep pain in the buttock or upper thigh with gradual onset and aggravated by repetitive activities like running, walking, or biking. The pain can also worsen with prolonged sitting.

The injury has even been referred to as *yoga butt*, as yoga practitioners have begun to experience this deep buttock pain due to the repetitive forward folding action and excessive stretching in a traditional vinyasa yoga class.

Diagnosis and Training

As trainers, we cannot *diagnose* Proximal Hamstring Tendinopathy but we can suggest our clients visit a specialist once these signs and symptoms have been described. Once there is a diagnosis and they are cleared to continue exercise, we can support them with cross-training as they rehabilitate the injury.

Isometric exercises are a great place to start and are recommended as the first stage of loading the hamstrings when PHT is present. Bridge holds are a suitable option for most and can eventually be progressed to a one-legged bridge. Over time, isotonic hamstring loading can be introduced when there is minimal to no pain.

Examples to begin with could be prone leg curls and hip extension as well as the Nordic hamstring exercise. Gradually increase the degree of hip flexion when loading hamstrings, eventually introducing exercises like lunges and deadlifts.

The final step would be progressing exercise and returning the client back to exercises they once performed, like bounding or kettlebell swings, or helping them return to their sport.

Moving forward, we can use our understanding of PHT to be proactive in preventing this injury from occurring, or recurring, in our clients so that training is no longer associated with a pain in the butt.

Bone Up on Calcium-Vitamin D Interactions

As the age of our clientele creeps up, so do questions about safeguarding skeletal health. While obtaining crucial vitamins and minerals from whole foods benefits the body optimally, calcium and vitamin D supplementation continue to generate controversy. Expert's, as well as layman's, beliefs fall on a spectrum, from extolling the virtues of supplements as "the elixir of life" to stating modest, if any, benefits *or* harm, all the way to characterizing supplements as stepping stones to heart disease and death.

The Tandem Effect of Calcium/Vitamin D

Vitamin D, traditionally known as the "bone vitamin", is vital to maintain bone mineral density. **However, a tremendous amount of scientific data exists linking low concentrations of serum vitamin D to an increased incidence of cardiovascular disease and mortality, among other things like dampened immunity and cancer.** Despite this alarming fact, most clinical trials have failed to find a positive link between vitamin D supplements and cardiovascular disease.

Several vitamin D–dependent calcium transport proteins regulate intestinal calcium absorption. Once absorbed into the small intestine, calcium and phosphorus can begin to form *hydroxyapatite crystals* which serve to strengthen/mineralize bones. Such knowledge substantiates the *need for a diet rich in vitamin D as well as calcium for proper bone mineralization.*

Sadly, the current US population tends towards insufficient levels of vitamin D. According to the *Third National Health and Nutrition Examination Survey*, 61% of white and 91% of black Americans suffer from severe vitamin D deficiency. As one can imagine, **such insufficiency can certainly lead to calcium malabsorption and further deficiencies**. **Without adequate vitamin D, the body can absorb no more than 10% to 15% of dietary calcium.** Even intestinal calcium absorption only approaches 30% to 40%.

Another Risk for Older Adults

Older Americans especially seem to fall victim to vitamin D deficiency. It tends to go hand-in-hand with osteoporosis, one of the country's biggest threats to our aging population. Several randomized trials recruiting physically challenged and ambulatory elderly subjects revealed how vitamin D in the absence OR presence of calcium reduced the rate of hip and/or nonvertebral fractures by 20-30%. *The combination of vitamin D and calcium does seem to contribute to further reduction of fracture incidence*.

Too Much of a Good Thing?

Whether suffering from osteoporosis or not, most adults remain unaware of the potential side effects of inappropriately high levels of calcium intake. Although rare in occurrence, overconsumption of calcium supplements can lead to a buildup that approaches toxic levels within the bloodstream. Some recent studies point to excessive calcium intake as increasing the risks of cardiovascular disease. Some of the warning signs of excess calcium in the body include:

- **nausea, vomiting, constipation;**
- **increased thirst or urination;**
- **muscle/bone pain;**
- **irregular heartbeat;**
- **dry mouth/metallic taste in mouth;**
- **confusion, fatigue, overall lack of energy.**

Similar to calcium, ingesting high doses of vitamin D over the course of time may lead to dangerously excessive buildup since it is a fat-soluble nutrient and will accumulate in tissue. “Intoxication” occurs when blood levels reach 150 ng/ml (375 nmol/l) and really takes a high intake of D over an extended period of time. Since this fat-soluble vitamin remains stored within adipose tissue, getting gradually released into the bloodstream, the effects of toxicity may last for several months after ceasing supplementation.

Overdosing vitamin D may also result in excessive absorption of calcium, which in turn may lead to the potentially dangerous symptoms listed above. Please seek provider guidance when supplementing with vitamin D for more than a few months.

Form and Function of Vitamin D

Important biological differences exist between vitamins D2 and D3. **Vitamin D3, considered the “active form” of the vitamin, offers a more profound effect on blood levels, significantly more than the synthetic form, vitamin D2**. For those individuals keen on supplementation, opting for D3 saves your body the extra step of converting D2, hence its increased efficacy in terms of elevating blood vitamin D levels. Bear in mind that it takes approximately four times the amount of supplemental D2 than D3 to raise serum levels, both forms are better absorbed when in emulsified forms.

Vexing Issue for Vegans

Most food sources of vitamin D hail from animals. Even the majority of vitamin D used in the preparation of supplements comes from *lanolin* (the wax secreted specifically from the sebaceous glands of wool-bearing animals). One primary challenge for many clients who have adopted a vegan lifestyle includes seeking out sources of calcium sufficient to meet their US RDA needs.

Vegans have the same calcium requirements as omnivores: 1,000 mg/day between the ages of 19 and 50; 1200 mg/day after age 50. Therefore, in the absence of dairy products, how can vegans ensure their consumption of the proper plant-based foods in the appropriate quantities?

Many lentil-type protein sources, often overlooked, score highly in terms of calcium content. A mere ½ cup of great Northern beans, black beans, or navy beans dishes out 50 mg. of calcium. A half cup of calcium-fortified tofu, a favorite among meat-free consumers, offers a versatile and delicious way of obtaining 200 mg. of calcium per serving.

Mushrooms claim the title of the sole vegan food source that naturally contains a good amount of vitamin D. However, many vegan-safe foods receive vitamin D fortification during processing, including:

- plant-based milk (flax, soy, or almond)
- cereal
- orange juice

Optimal absorption of fat-soluble vitamins such as vitamin D comes from pairing intake with a source of healthy nutritional fat, such as olive oil, avocado, nuts, or seeds.

Beware of the Offending Oxalates

Compounds known as oxalates, heavily present in some leafy green vegetables, can inhibit the absorption of calcium. Beet greens, Swiss chard, rhubarb, and spinach contain abundant quantities of calcium as well as other beneficial nutrients, but unfortunately possess high amounts of oxalates. However, by choosing alternative dark leafy greens — such as collard, kale, and mustard greens — which contain fewer oxalates, the calcium present in these vegetables gets absorbed at a very good rate.

Supplement Take-Home Message

At this time, experts advise against recklessly prescribing vitamin D supplements in an attempt to prevent cardiovascular disease, especially in conjunction with calcium supplementation. As with so many other examples, it seems in our best interests to strive for the recommended daily allowances of calcium intake through food, reserving supplementation for those at risk for severe deficiencies. In future studies, scientists will strive to more deeply examine the health effects of supplementation, prior to offering any solid recommendations for individuals of different genders, ages, and ethnicities.

Leaky Gut Syndrome: Ailment without Answers

Imagine trying to identify an "illness" about which medical schools never teach. *Leaky gut syndrome* falls into such a category and as of late, has gotten much attention. Experts have even gone so far as to wonder whether it really exists. According to Dr. Linda A. Lee, a gastroenterologist and Director of the Johns Hopkins Integrative Medicine and Digestive Center, "In the absence of evidence, we don't know what it means or what therapies can directly address it."

Intestinal Permeability

Leaky gut syndrome commonly associated with bloating, cramps, and food sensitivities, remains somewhat of an enigma in the medical field, but is generally understood as increased intestinal permeability. Problematic increases in intestinal permeability or intestinal hyperpermeability top the list of possible culprits in the onset of a leaky gut and the ensuing malabsorption of vital nutrients. The cells lining the intestines (epithelial layer) form a porous barrier. The normally secure, tight gut junctions function as the gate-keepers of which substances pass through the small intestinal lining.

This passage enables the body to absorb ingested nutrients from the foods we eat. When these junctions become enlarged in size, unwanted substances can enter the bloodstream, often leading to bothersome inflammation. Under conditions where the permeability of this lining finds itself compromised, toxins and bacteria can enter the blood stream… hence the term "leaky" gut. The leak leads to inflammation, bloating, stool changes, nutritional deficiencies, and fatigue.

In individuals with such a genetic predisposition, a leaky gut allows entrance of environmental factors, thereby initiating the cascade of events that can bring about autoimmune diseases (celiac disease, irritable bowel syndrome and Crohn's, to name a few). Some studies show a correlation between leaky gut and autoimmune diseases **occurring outside of the digestive tract**, such as lupus, type 1 diabetes, fibromyalgia and arthritis.

Once the immune system gets activated, its cells travel from the gut and begin attacking tissues and organs randomly, including the brain/CNS. This leads to the common complaints of so many individuals who suffer from leaky gut syndrome: a feeling of "brain fog", lack of focus/concentration, fatigue, anxiety, and depression.

Lifestyle Likely to Blame

The medical profession does acknowledge, to a certain degree, that today's lifestyle may play a significant role in the development of leaky gut syndrome. Our typical Western diet, laden with sugars and saturated fats plus notoriously lacking in fiber, figures prominently. Seeking out a gastroenterologist with a strong background in gut-related nutrition, or even a skilled nutritionist that can perform micronutrient testing, can make a big difference for many sufferers.

Chronic stress also contributes to a large percentage of leaky gut cases. Dr. Lee suggests trying meditation *before* medication as a means of mitigating life's daily pressures. When combined with diet modifications, holistic treatments fit the bill, especially when more invasive tests fail to identify any underlying pathology. Proponents hope that such measures can at least lessen the effects of an unhealthy and frenetic lifestyle.

The Path Toward a Healthier Gut

A great amount of attention these days focuses on the "superpowers" of both apple cider vinegar and lemon water for promoting a healthy gut. Do the products live up to the hype?

Unfortunately, a very small amount of evidence exists to cause much of a stir; still, proponents extoll the virtues of sipping lemon-infused hot water or apple cider vinegar mixed with warm water first thing in the morning as a panacea for gut ailments.

The polyphenols, enzymes, and beneficial bacteria contained in the so-called "mother" of apple cider vinegar may foster a better microbiome in the gut. The fiber (most notably pectin), as well as the abundance of vitamin C, found in lemons can potentially lessen gut inflammation. However, one must weigh this against the possibility of acidic erosion of tooth enamel with overconsumption.

Tea Time

While green tea leads the pack in antioxidants, a new contender in the hot beverage family might just work better towards alleviating leaky gut syndrome. Blue tea, the centuries-old gem from Southeast Asia, resembles traditional tea but comes under the classification of "tisanes", beverages not actually prepared from tea leaves but rather made by infusing leaves and flowers from the *Clitoria ternatea* plant.

A study appearing in the *International Research Journal of Pharmacy* revealed that the antioxidant level found in blue tea shows great promise in the treatment of both external and internal (gut-related) inflammation. Another research study, the data of which appeared in the prestigious *Journal of Pharmacology, Biochemistry and Behavior*, points to evidence that regular consumption of blue tea can positively affect stress-related mood swings and the central nervous system in general. Once again, the potential for relief by sipping hot tea underscores the importance of **finding ways to deal with the symptoms of leaky gut, even in the absence of a definitive diagnosis**.

The Gut and Glutamine

Many web sites offer information on treating leaky gut, despite a lack of research on the subject. Believers extoll the virtues of **taking L-glutamine supplements to strengthen the lining of the small intestine**. Glutamine, considered "the fuel of the intestinal cell lining", helps regenerate the cells, which incidentally heal faster than the majority of tissues anywhere else in the human body. However, such claims remain largely anecdotal, based more upon theory than scientific data.

Take-Home Message

As we have come to understand, anything that causes irritation of the intestinal epithelium can potentially trigger leaky gut syndrome. Doctors note the following as the most common causes:

- Food sensitivities (especially gluten and dairy)
- Infections
- Overuse of NSAID's
- Environmental toxins
- Stress

Although still considered unusual to hear the term “increased intestinal permeability” in most doctors’ offices, alternative and integrative medicine practitioners have worked on gut healing as an initial step to treat chronic diseases for decades. We can only hope that future studies help elucidate the problem. Still, when speaking with patients, physicians will always stress the current lack of reliable information on this mystifying ailment.

Oxidative Stress: Fighting the Free Radical Damage

Both scientific and anecdotal evidence consistently indicates that more active individuals tend to experience greater longevity and a reduced risk of coronary heart disease, stroke, and many forms of cancer. **A *regular, moderate exercise routine* leads to higher natural antioxidant levels** and therefore a decreased chance of the potential damage inflicted by oxidative stress. However, *regularly engaging in a very high volume of aerobic exercise can bring about a significant uptick in oxidative stress*, causing typically healthy exercise to work against us.

Exercise vs. Physical Activity

According to the *American College of Sports Medicine* and the *American Heart Association,* the following provide explanations of, and the subtle differences between, physical activity, exercise, and cardiovascular exercise:

- **Physical activity** means movement requiring energy, carried out by the muscles.
- **Exercise** refers to planned, structured, repetitive and intentional movement, with the goal of improving/maintaining physical fitness.
- **Cardiovascular exercise** describes exercise that challenges the heart and vascular systems, designed to increase the heart's ability to pump blood and distribute oxygen to tissues throughout the body.

Clearly, any or all of these "verbs" serve to benefit the body. However, as in all things, *moderation works best*.

The Paradox of Oxidation

Simple *oxidation* within the body, a very necessary property of healthy cells, differs greatly from *oxidative stress*. **When the presence of free radicals matches the body's level of antioxidant activity, the normal process of oxidation serves to eradicate pathogens (germs that cause infections).** Exercise plays a positive key role in this process, as we will read in subsequent sections of this article, as does proper nutrition.

Free radicals, or *oxygen reactive species*, refer to those oxygen-containing molecules within the body that *possess an uneven number of electr*ons, leaving them free to cause the large-chain reactions we call oxidation. As noted above, our bodies actually require this process to ensure proper, healthy function.

The problematic side of the paradox begins when the body detects an *imbalance between the presence of antioxidants and free radicals*. Too many roaming free radicals sets the cycle of damage in motion that ultimately impacts DNA, proteins, and other tissues within the body, rendering us vulnerable to oxidative stress. Since oxidative stress relates strongly to the pathogenesis of lifestyle-related diseases — atherosclerosis, high blood pressure, diabetes, Parkinson's/Alzheimer's diseases, and even some malignancies – this condition over time contributes to the aging process itself. Overzealous fitness fanatics who engage in tremendous amounts of aerobic exercise also place themselves at high risk of oxidative stress damage.

Free Radicals and Heart Disease

During recent years, accumulating data have elucidated the process of how oxidative stress works as a causative agent for the many aforementioned disease states, most specifically regarding cardiovascular problems. Plaque formation within the arteries results from inflammation of cells' endothelial lining, which in turn generates more free radicals. When an overabundance begins to surge throughout the body, targeting

and oxidizing low-density lipoproteins (LDL), the resulting accumulation of lipids will typically end up forming atherosclerotic plaque.

Symptoms of Oxidative Stress

What telltale signs reveal the presence of serious oxidative stress roaming throughout the body? The list below comprises the most commonly reported effects:

- Fatigue
- Memory loss and/or brain fog
- Muscle and/or joint pain
- Diminished eyesight
- Headaches/noise sensitivity
- Susceptibility to infections

One may easily argue the point that all of these symptoms typically occur with advancing age. We mentioned above that excessive oxidative stress can contribute to the aging process. The more scientists learn and share information regarding the detrimental effects of oxidative stress, the more we can begin to see a clear picture emerging. Once again, we must underscore the importance of *moderate exercise* in maintaining a properly functioning healthy body.

Achieving Antioxidant Abundance

Antioxidants delay or prevent cellular damage by their inherent ability to detect, and therefore disarm, the presence of free radicals. They accomplish this by easily donating their extra electrons to free radicals while remaining stable themselves, in effect neutralizing those dangerous substances and slowing their damaging effects. The body cannot manufacture some of the key antioxidants, such as Vitamin E, Vitamin C, and beta-carotene; therefore, these must be obtained from food sources…the reason we encourage the public to consume colorful fresh fruits and vegetables in abundance daily.

Amplifying Absorption

As with so many other food sources, a certain percentage of individuals will present with allergies to healthy and antioxidant-rich fruits and vegetables. To serve this need, efforts have been made to identify antioxidant-rich micronutrients and healing natural compounds (nutraceuticals) which demonstrate the ability to prevent or attenuate exercise-induced oxidative stress and inflammation. **The search has intensified in recent years, with a focus on the properties and benefits of three natural substances: quercetin, resveratrol and curcumin.**

These antioxidant-rich plant derivatives have enjoyed much popularity in supplement form as a means of ameliorating such health problems as cardiovascular disease, cancer, diabetes, and the overall aging process – the unfortunate results of too many free radicals. Unlike the consumption of whole foods, however, the poor absorption rate and hence bioavailability of each of these renders them less potent.

Recently, scientists have uncovered the secret to boosting their benefit: *ingesting quercetin, resveratrol, and curcumin together* dramatically increases the compounds' intestinal absorption, placing them exactly where they can have the greatest effect on the body.

Purposeful Movement

As personal trainers, there will undoubtedly come a time when we interact with clients who do not share our joy of fitness-related movement. When working with these individuals, we need not concern ourselves (or them) with the oxidative stress risk brought about from overdoing high-volume aerobic exercise, as clearly any risk of this happening seems minimal at best. For these clients, the other side of the coin must take top priority. Our goal always remains to cultivate a safe and positive outlook on exercise, one that promotes and fosters not only improvements in body mass, endurance, flexibility, balance, and self-esteem, but also keeps the inner physiological mechanisms running smoothly.

The Air Pressure is On: Running Against the Barometer

For years, athletes both recreational and professional have accepted the fact that running at higher elevations poses a unique challenge. The air density diminishes at high elevations, rendering the oxygen molecules necessary to fuel the lungs fewer in quantity. Understanding the effects of air pressure on pain and performance may help your clients adjust to and successfully overcome this barrier.

The Theory of Air Pressure on Pain Experience

At sea level, *the air one breathes experiences a compression of 6000 more vertical feet of atmosphere* than the air found in Colorado Springs, for example. This translates to a denser packing of oxygen molecules than what a runner would encounter at a higher elevation, and ultimately, more available oxygen.

Barometric pressure measures the weight of the surrounding atmosphere. Drops in barometric often herald the onset of storms or drastic changes in weather. Such lowered air pressure very often causes joint discomfort. By exerting *less of a force* upon the body, tissues around the joints can expand. Such expansion in turn applies pressure to the joints, very often eliciting pain.

However, the reverse proves true as well. Tissues that surround the knee joint resemble a balloon, with a finite capacity. *Increasing atmospheric pressure* in this case inhibits the expansion capability of these delicate tissues, thereby eliciting pain. Dr. David Hassinger, orthopedic surgeon and founder and CEO of Direct Orthopedic Care, offers an explanation for this phenomenon.

“Arthritis affects everything within the joint, including the lining and ligaments. All of those tissues have nerve endings that can feel changes in the weather, which may result in tightness, stiffness, and some discomfort.” For a competitive distance runner, this can potentially spell disaster…or at the very least, a potentially painful event.

Back in 2007, The Arthritis Foundation published the results of a study undertaken at Tufts University. Scientists determined that not only can lower barometric pressure cause joint pain; a plunge in air temperature yields the same results. **Their data suggests that for every 10-degree drop in temperature, subjects observed an incremental increase in arthritis symptoms.** When older adults claim to know in advance of an imminent weather pattern shift because “their knees hurt”, we should no longer scoff at or doubt their predictions.

The Veracity of the Correlation

Not every scientist agrees with the above data. The majority of studies attempting to quantify any pain-weather association pointed to arthritic subjects’ inclination to “assume” that their joint pain corresponded to weather changes. The fact that individuals living with other chronic pain issues (such as fibromyalgia or polymyalgia) typically find no link between their discomfort and pending storms substantiates this conclusion.

To test this theory, researchers Redelmeier and Tversky looked into whether or not the intensity of an individual’s pain truly corresponded to weather conditions. **A self-assessment of pain showed no alignment between intensity and barometric pressure, nor temperature and/or humidity, for that matter.** Once again, scientists found themselves reverting to the “assumption” theory. Perhaps dreary, cold and wet conditions correlate more directly with a dismal mood/outlook, during which normal pain might take on greater importance in a subjective brain.

Whether actual or assumed, an athlete experiencing acute pain typically delivers a poor performance. Understanding why this happens can confer a modicum of psychological comfort, although in the moment (or hours, for distance runners) that pain seems relentless. Coupled with the lessened amount of available oxygen, this double-pronged situation often appears overwhelming.

Altitude and the Distance Runner's Experience

Clients preparing for a long-distance running event at a higher altitude can receive proper coaching to facilitate endurance and overall performance**. Any sport highly aerobic in nature naturally requires a great deal of oxygen, not only for breathing but also to fuel muscular contractions.** This process occurs as a result of *oxidative metabolism*. At any elevated altitude, defined as anywhere from 8,000 to 18,000+ feet above sea level, the decrease in available oxygen translates to inefficient oxidative metabolism, causing running performance to suffer.

Over 25 years ago, treadmill tests conducted by British researcher Mervyn Davies indicated that for every 1% increase in grade, even an elite runner's pace slowed by ~3%. Such an incline accounts for 52.8 feet/mile. From this data, we can extrapolate that running time increases by 10 seconds/mile for those able to sustain a 5-minute mile. As one might expect, a 2% gradation doubles the effect (100 feet of climbing), 3% triples the length in running time, etc.

Short of relocating permanently to train in "thinner air", a distance runner might choose to *arrive at the site of the competition 3-4 weeks in advance.* By completing his training in this new atmosphere, his body can adjust slowly. By the time of the event, the runner's body can boast a red blood cell count increase. As a result, both mitochondrial and capillary densities also increase. All these factors contribute to a more comfortable and successful distance competition.

High Altitudes Favor Sprinters

As much as distance running can take a hit when in Colorado Springs, a sprinter thrives in such an atmosphere. Since the action of sprinting relies less on oxygen consumption/oxidative metabolism and more on the body's *ATP PC system*, such a reduction in air resistance leads to faster runs.

The ATP-PC system consists of adenosine triphosphate (ATP) and phosphocreatine (PC). Immediate energy gets generated via a breakdown of stored high-energy phosphates; this system can manufacture ATP faster than any other in the human body. A properly fueled ATP-PC system can provide ample energy during maximal intensity, short-duration exercise (sprinting), lasting a good 10-15 seconds before fatigue sets in. We may liken this to a car's V8 engine: its power does not last for the length of an extended car trip, but performs exceedingly well for one lap around a track.

In the Final Analysis

While many conditions, both weather-related and psychological, may contribute to less than stellar distance running, understanding and thereby properly preparing for high-altitude events and changes in air pressure can foster not only one's performance but his emotional outlook as well.

How Nitric Oxide Improves Muscular Contractions

Though the exact method remains somewhat unclear, dietary nitrate (a source of nitric oxide or NO) appears to improve the contractile properties of human muscle. Find out how athletes utilize this supplement to enhance performance!

Boosting Blood Flow

The nitrate-nitrite-nitric oxide pathway, fueled by food sources of nitrate and nitrite, reflects the largely accepted benefits of good nutrition, especially the consumption of leafy vegetables.

Recent studies have examined the effects of dietary nitrate as a significant source of nitric oxide (NO) in the body, especially important for individuals living with cardiovascular disease. Research initially focused on the vasodilation properties of NO and its effects on blood pressure. In 2007, however, Larsen *et al*. reported that ingestion of NO_3^- at a dose of 100 $\mu mol \cdot kg^{-1}$ per day for three days lowered the steady-state rate of O_2 uptake ($V\dot{O}_2$) during submaximal exercise. Dietary NO_3^- also has been shown to enhance blood flow to the muscles during exercise. Data points indicate that fast-twitch muscle tissue shows the greatest relative increase in blood flow.

Nitric Oxide and Performance

More recently, dietary NO_3^- has drawn a lot of attention with its ability to enhance the contractile properties of skeletal muscle tissue, including speed and power. According to an article appearing in the *Sports Journal*, studies have shown that taking nitric oxide supplements may enhance one's tolerance to exercise. This behavior manifests itself across a broad range of individuals: both well-seasoned and untrained athletes, older individuals, and those who have experienced past heart failure.

Scientists postulate that changes in calcium signaling, responding to the increased availability of NO in the bloodstream, bring about this shift. In clinical trials, physicians see promise in patients with cardiovascular diseases whose bodies struggle with the ability to transport oxygen to working tissues, thereby mitigating their reduced exercise tolerance.

The Virtues of The Beet

Nutritional sources such as beetroot, beetroot juice and dark green leafy vegetables top the list in terms of providing exogenous nitrate. When the body transforms this into nitrite and potentially nitric oxide, vasodilation as well as mitochondrial biogenesis occur. Utilizing a similar yet slightly different pathway in the body, L-arginine too stimulates nitric oxide synthesis in the endothelium. Such findings have led athletes to focus upon both L-arginine and NO as natural sources of performance-enhancing supplementation. Further studies may elucidate the risks and benefits of supplementation as high as 1 gram/day of nitrate, focusing particularly on any detrimental effects to the nephrology system.

Good For Some, Not For All

Doctors have noted that taking nitric oxide supplements could exacerbate some pre-existing conditions, including kidney disease and the typical health concerns following a heart attack. A 2006 study published in the prestigious *Journal of the American Medical Association* found that patients taking L-arginine after having experienced a heart attack rendered them more vulnerable to the chance of a second incident and/or death than those individuals not taking this supplement.

Dietary or environmental exposure to nitrate has historically been viewed as harmful to our health, most specifically pointing to a predilection toward gastric cancer. Nitrate and nitrite in and of themselves do not present as carcinogenic. However, under conditions that result in endogenous "*nitrosation*", a term referring to reactions introducing an NO group into an organic molecule, the possibility does exist where ingested nitrate and nitrite may lead to increased cancer risk in humans.

No More Lunch Meat?

Admittedly, questions and debates abound on this topic; more in-depth research may eventually elucidate a reliable benefit/risk assessment in terms of long-term health. Some of the epidemiological studies to date reveal somewhat of an association between cancer and nitrate-laden cured and processed meats. Once again, this connection needs more research, given that such a low risk seems almost negligible when compared to the virtues of dietary nitrite/nitrate.

The Inflammatory Response

While the presence of nitric oxide in the body confers certain benefits on host defense and homeostasis, scientists and athletes must not discount the knowledge that NO often finds itself implicated in many inflammatory and autoimmune diseases. A study on patients with periodontal disease indicated that low concentrations of basally produced nitric oxide can offer homeostatic protection in certain tissues. However, NO in excessive amounts causes an inflammatory reaction that may destroy host tissues. As a result, medical professionals may opt to assess serum levels of NO as an indicative inflammatory marker for the progression of autoimmune diseases.

Side Effects of Nitric Oxide

As with all forms of supplementation, even generally healthy adults may experience occasional side effects of NO. The most commonly reported discomfort includes:

- stomach pain/loose bowels/bloating/nausea
- heart palpitations
- headaches

For a regularly active individual, these can range from mild and bothersome to potentially significant. However, a unique demographic of the population ought to steer clear of this supplement. For these people, potential side effects could have dangerous health consequences:

- **Cirrhosis:** People with liver scarring must proceed with caution, as supplemental NO could worsen liver function.
- **Guanidinoacetate methyltransferase deficiency:** This rare condition occurs when a person lacks an enzyme that converts arginine into creatine, which is a waste product. As a result, people with this deficiency should not take nitric oxide supplements.
- **Low blood pressure:** If an individual currently has hypotension, nitric oxide supplements may cause an undue further lowering of blood pressure.
- **Pending surgery:** Medical professionals typically recommend temporarily suspending use of nitric oxide supplements for 7- 10 days prior to any surgical procedure.

Recommending Nitric Oxide Supplementation

At this juncture, armed with the total picture, trainers must decide which path to take regarding endorsing supplemental L-arginine and NO. We may not necessarily encounter cardiac rehab clients seeking our opinions on exogenous, non-dietary supplements. However, many avid athletes, especially those in a competitive arena, may solicit our opinion on such matters. In these cases, as fitness professionals, we owe it to our clients to speak openly and honestly about the advantages as well as the health risks.

SELF – TEST: June 2021

1. Perimenopause refers to the:
    a. Internal structures related to menopause
    b. Few years leading up to menopause
    c. Symptoms related to menopause
    d. None of the above

2. Which of the following is a common menopausal complaint:
    a. Midsection weight gain
    b. Weakening of bones
    c. Anxiety and depression
    d. All of the above

3. According to the Department of Health and Human Services, an ideal exercise prescription for menopausal female clients is:
    a. Aerobic activity performed moderately for a total of 2 ½ hours/week
    b. Intense resistance training 3 times per week
    c. Stability exercises that challenge the core, daily
    d. Strictly yoga and pilates, alternating 3 time per week

4. How can overtraining be detrimental to the female client?
    a. By signaling excess cortisol, the key culprit of belly fat
    b. By producing too much testosterone, restricting fat removal
    c. By making glucose readily available, keeping insulin from being used
    d. By repeating the estrogen cycle, signaling an increase in estrogen production

5. Plantar Fasciitis involves:
    a. Degeneration of the plantar fascia
    b. Inflammation of the plantar fascia
    c. Pain in the heel and foot
    d. All of the above

6. Which of the below is an option for getting the client's heart rate up without putting repetitive strain on the plantar fascia?
    a. Stationary cycling
    b. Long distance running
    c. Short distance sprinting
    d. Plyometric training

7. Lower body exercises should be avoided while recovering from plantar fasciopathy.
    a. True
    b. False

8. BCAAs improve metabolic health overall, what are BCAAs?
    a. Benign Cancer Activation Areas
    b. Branched-Chain Amino Acids
    c. Beginning Complications of Acidic-Aligners
    d. None of these are BCAAs

9. Excessive amounts of BCAAs in plasma levels align with an elevated risk of:
    a. Metabolic disorder
    b. Type 2 diabetes
    c. Both A and B
    d. Neither A nor B

10. During exercise, muscle protein synthesis decreases as protein degradation increases.
    a. True
    b. False

11. The hard-working athletic body requires a sufficient amount of _____ in order to re-establish a positive nitrogen balance.
    a. Cortisol
    b. Testosterone
    c. Leucine
    d. Fatty Acids

12. Unlike most amino acids, which are processed in the _____, BCAAs are primarily metabolized with _____.
    a. Liver; muscle tissue
    b. Muscle tissue; liver
    c. Pancreas; Liver
    d. Liver; Pancreas

13. Nutritional restoration, allowing for improved hypertrophy through protein synthesis, can be consumed through which of the following foods that contain a spectrum of BCAAs?
    a. Lean meat and fish
    b. Leafy vegetables
    c. Nuts and berries
    d. None of these

14. It is never appropriate to use a 'tough love' approach with clients.
    a. True
    b. False

15. According to sports psychologist, Graham Jones, star athletes and business people share this defining trait:
    a. Physical strength
    b. Public speaking ability
    c. Mathematical skills
    d. Mental toughness

16. The following should be considered by the trainer before deciding on a training style:
    a. The client's best interest
    b. Realistic goals for the client
    c. 'Knowing your audience'
    d. All of the above

17. Metabolic adaption refers to:
    a. the idea that you can change metabolic rate through mental strength
    b. the means by which metabolism adapts to one's lifestyle over time
    c. the ability to reverse a negative metabolic effect of unhealthy eating habits
    d. a measure of how the citric acid cycle adapts to the metabolic rate

18. Metabolic confusion refers to:
    a. an eating style that alternates between high and low-carb days
    b. a misunderstanding of the metabolic cycle and how eating habits effect it
    c. a denial that carb intake has any relation to metabolic processing of food
    d. a starvation eating trend that promotes eating no carbs to increase metabolism

19. Carb cycling:
    a. maximizes fat loss without deprivation of either nutrition or energy
    b. promotes the fasting from carbs and fats on alternating days
    c. is a cycle of eating only simple carbs versus only complex carbs on alternating weeks
    d. none of these is carb cycling

20. Metabolic confusion by carb cycling is said to:
    a. "trick' the body's metabolism into working harder, resulting in fat loss
    b. Alternating between high and low carb days will 'confuse' the body's metabolic rate
    c. The body will have to work harder to adapt to changes in calorie intake, especially when coupled with prudent exercise
    d. All of the above

21. Exercise leads the body to tap into its _____stores for energy
    a. protein
    b. ATP
    c. carb
    d. glucose

22. High carb days are intended for:
    a. Low level exercise days
    b. Days without exercise
    c. Intense exercise days
    d. Resistance exercise days only

23. Low carb consumption can range from:
    a. 50-150 grams per day
    b. 160-200 grams per day
    c. 250-400 grams per day
    d. All of these ranges are too high for carb intake

24. _____ is the most important thing for any diet to be successful; we know people don't stick with overly restrictive diets."
    a. Adherence
    b. Acceptance
    c. Bravery
    d. Employment

25. Vitamin D is traditionally known as:
    a. Simple vitamin
    b. Bone vitamin
    c. Ineffective
    d. Most Important

26. Hydroxyapatite crystals are formed by _____ and _____, which _____ bones.
    a. Vitamin D; sodium; creates
    b. Calcium; vitamin D; strengthen
    c. Phosphorous; calcium; creates
    d. Calcium, phosphorous, strengthen

27. Without adequate vitamin D, the body can absorb no more than 10% to 15% of dietary _____.
    a. Calcium
    b. Phosphorous
    c. Sodium
    d. Vitamin C

28. It is in our best interest to strive for recommended daily allowances through food sources.
    a. True
    b. False

29. The hamstring muscles are:
    a. Primary knee flexors and secondary hip extenders
    b. Secondary hip flexors and primary knee extenders
    c. Primary glute adductors and secondary hip abductors
    d. Secondary hip adductors and primary glute abducters

30. If a client complains of a 'pain in the butt', this may be an injury to:
    a. The ligament at the attachment of the gluteus minimus of the hip
    b. The tendon at its attachment on the ischial tuberosity of the pelvis

31. When Proximal Hamstring Tendinopathy, PHT, is present, what is the recommended first stage of exercises?
    a. Isotonic hamstring loading exercises
    b. Isometric hamstring loading exercises

32. Leaky Gut Syndrome is commonly associated with:
    a. Bloating
    b. Cramps
    c. Food sensitivities
    d. All of the above

33. Leaky gut syndrome seems to be caused by:
    a. an increasing strength of an impermeable intestinal tract
    b. increases in intestinal permeability or hyperpermeability
    c. the disconnection of colon and intestinal tract
    d. a cancerous growth in the gut

34. Some studies show a correlation between leaky gut and:
    a. Celiac disease
    b. Irritable bowel syndrome
    c. Autoimmune diseases
    d. All of these

35. Irritation of the intestinal epithelium can potentially trigger leaky gut syndrome. Doctors note the following as the most common cause/s/:
    a. Overuse of NSAIDs
    b. Probiotics
    c. Increased testosterone
    d. Gluten free dieting

36. Oxygen-containing molecules within the body that possess an uneven number of electrons, causing the large-chain oxidation reaction, are called:
    a. Molecular time bombs
    b. Stifled hormones
    c. Free radicals
    d. Carbon monoxide killers

37. Our bodies require the process of the large-chain oxidation reaction to ensure proper, healthy function.
    a. True
    b. False

38. Ingesting the following three natural substances, together, places these compounds where they can have the greatest effect on the body to dramatically increase intestinal absorption:
    a. Quercetin, Calcium, and Vitamin D
    b. Resveratrol, Quercetin, and Vitamin D
    c. Calcium, Curcumin, and Resveratrol
    d. Curcumin, Quercetin, and Resveratrol

39. Barometric pressure measures:
    a. the density of air pressure in mountainous regions
    b. the weight of the surrounding atmosphere
    c. the humidity of the environment
    d. the height at cloud level of the atmosphere

40. Drops in barometric pressure often preclude the onset of storms, in turn it is said to elicit joint pain. Why is this?
    a. It is only psychosomatic, there is no actual reason for it.
    b. Because higher pressure means that there is more air force exerted on the body, this heavier force of gravity brings about body pain.
    c. Because lowered air pressure, which can result in storms, exerts less of a force on the body allowing tissues to expand which applies pressure to the joints and causes pain.
    d. There is a collision between high and low barometric pressures, causing a molecular reaction in the atmosphere that is felt inside the body, especially in less formable structures, like joints, causing pain.

41. Since the action of sprinting, as opposed to long distance running, relies more on oxygen consumption/oxidative metabolism and less on the body's *ATP PC system*, a reduction in air resistance leads to slower runs.
    a. True
    b. False

42. Dietary nitrate (a source of nitric oxide or NO) appears to improve the _____ _____ of human muscle.
    a. Contractile properties
    b. Oxygen conversion
    c. Fat break-down
    d. Protein uptake

43. The possibility does exist where ingested nitrate and nitrite may lead to increased cancer risk in humans.
    a. True
    b. False

44. Excessive amounts of ingested NO can cause this type of reaction that may destroy host tissues:
    a. Painful
    b. Inflammatory
    c. Constrictive
    d. tearing

45. As a personal trainer, you will most likely be asked for opinion about supplementation (especially by competitive athletes). In these cases, as a fitness professional, you should:
    a. Speak honestly about the health risks
    b. Be open about advantages of certain supplements
    c. Give information and allow the client to form their own opinion and/or supplemental game plan
    d. Talk through all of these things when asked about supplements

Thank you for completing this NFPT Self Test. Our thoughts and best wishes are with you!

SIDE 1

○ RESCORE | ○ MARK ✓ ○ TOTAL ONLY/BOTH SIDES

Trans-Optic® forms by NCS Pearson MM19641-2 654321

	T	F
1	A	B C D E
2	A	B C D E
3	A	B C D E
4	A	B C D E
5	A	B C D E
6	A	B C D E
7	A	B C D E
8	A	B C D E
9	A	B C D E
10	A	B C D E
11	A	B C D E
12	A	B C D E
13	A	B C D E
14	A	B C D E
15	A	B C D E
16	A	B C D E
17	A	B C D E
18	A	B C D E
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21	A	B C D E
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40	A	B C D E
41	A	B C D E
42	A	B C D E
43	A	B C D E
44	A	B C D E
45	A	B C D E
46	A	B C D E
47	A	B C D E
48	A	B C D E
49	A	B C D E
50	A	B C D E

KEY ITEM COUNT

0	0	0
1	1	1
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9

1 FEED THIS DIRECTION

NFPT ID

0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

MARKING INSTRUCTIONS

Use a No. 2 Pencil

Ⓐ ● Ⓒ Ⓓ Ⓔ
Fill circle completely

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
Erase cleanly

SCORE		# CORRECT
		% CORRECT
RESCORE		# CORRECT
		% CORRECT
ROSTER NUMBER		SCORE
		RESCORE

NAME _____

SUBJECT **JUNE 2021 CEC Self Test**

PERIOD _____ DATE _____

TEST ANSWER SHEET B
Form No. 19641

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