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Personal Training Quarterly (PTQ) publishes basic educational information for Associate and Professional Members of the NSCA specifically focusing on personal trainers and training enthusiasts. As a quarterly publication, this journal's mission is to publish peer-reviewed articles that provide basic, practical information that is research-based and applicable to personal trainers.

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PRACTICAL BLOOD FLOW RESTRICTION TRAINING

JEREMY LOENNEKE, PHD, ROBERT THIEBAUD, PHD, AND TAKASHI ABE, PHD

Blood flow restriction (BFR) alone or in combination with low-load/intensity exercise has been shown to produce favorable changes in skeletal muscle (8). BFR is applied to the proximal part of the arms or legs with the intent to restrict arterial blood flow into the muscle while occluding venous outflow (5). In the absence of exercise, repeated cycles of BFR may attenuate atrophy and declines in strength. In addition, low-intensity aerobic exercise in combination with BFR produces small changes in muscle size and strength over those observed with exercise alone. However, the magnitude of change in muscle size and strength is largest when done in conjunction with low-load resistance training, which produces results similar to those observed with high-load resistance training (5). Low-load resistance training should be considered 20 – 30% one repetition maximum (1RM). The favorable muscular effects of BFR do not appear to be localized distal to the BFR stimulus as increases in size and strength have been observed in muscles not directly under BFR (e.g., pectoralis major) (1). Until recently, all of the research on BFR was completed using specialized devices that allowed for strict regulation of pressure. In 2009, a practical model of BFR was proposed that involved the use of elastic wraps (6). The purpose of this article is to discuss the available research behind this practical model.

BENEFITS OF BLOOD FLOW RESTRICTION

Exercise in combination with BFR has been shown to result in favorable chronic adaptations across a variety of populations, including the elderly, highly trained athletes, those recovering from injuries (e.g., ACL, osteochondral fracture), as well as patients diagnosed with idiopathic inflammatory myopathy (2,3,4,10,13,14). While most research has been completed using specialized

devices, recent research lends support to the efficacy of practical BFR from elastic wraps. To illustrate, low-load resistance exercise in combination with BFR increased muscular strength over those observed with the group completing the same exercises without BFR (17). In addition, the application of practical BFR with low-load training resulted in similar changes in muscle size as traditional high-load training (11). Furthermore, a recent case review provided evidence that practical BFR may be an effective stimulus for rehabilitating a knee injury (10). More research is needed but preliminary results appear to support practical BFR.

MECHANISMS

Currently, the proposed mechanisms of the BFR-induced muscle hypertrophy include acute muscle cell swelling, increased fiber type recruitment from metabolic accumulation, decreased myostatin, decreased atrogenes, and the proliferation of satellite cells (5). Some of these have also been shown to occur with the practical model of BFR (5). The application of elastic wraps has been shown to increase acute muscle cell swelling, increase metabolic accumulation, and increase muscle fiber recruitment (16). It stands to reason that the other proposed mechanisms may also occur with practical BFR, but more research is needed at this time.

SAFETY OF BLOOD FLOW RESTRICTIONS

One important point to note is the safety of BFR. Frequently, the blood pressure, blood coagulation, and muscle damage responses are cited as concerns for using BFR in combination with exercise. However, the application of BFR appears to offer no greater risk than regular high-load resistance training when the stimulus is used appropriately.

To illustrate, the cardiovascular responses to exercise in combination with BFR are generally lower than those observed with higher load resistance training (9). Further, the coagulation cascade has not been shown to activate following the application of BFR in those who are healthy or in those with ischemic heart disease (12). In contrast, the research suggests that BFR exercise may actually enhance fibrinolytic activity (9). Finally, BFR in combination with resistance exercise does not appear to produce large, meaningful changes in the indirect markers of muscle damage (9). Some participants report delayed onset muscle soreness (DOMS) with this technique, but this occurs independently of large decreases in performance. The available evidence does not support the hypothesis that BFR in combination with low-load exercise increases the incidence of muscle damage (7,15,16).

APPLYING ELASTIC WRAPS

When applying the elastic wraps, they should be placed at the top of each leg or at the top of each arm (Figure 1). In order to set the appropriate tightness, it is important to understand that the pressure applied should be high enough to occlude venous return from the muscle but low enough to maintain arterial inflow into the muscle (5). Thus, wraps need to be applied tight enough to cause a visual fluid shift and maintain metabolites in the working muscle, but not so tight that arterial flow is cut off completely (5). Recent studies have proposed wrapping at a perceived tightness of 7 out of 10 to achieve this effect (16). Further, practical recommendations include being cognizant of the following points:

1. If the wraps are applied to an individual and they are in pain before exercise, then the wraps are too tight.
2. A typical protocol used in the literature is 30 repetitions followed by 3 sets of 15 repetitions (with 30 – 60 s of rest between sets). If an individual is not getting close to that goal amount of repetitions, and the load is set to 20 – 30% of their 1RM, then the wraps are too tight.

Given that arterial occlusion is also dependent upon limb circumference, it may be more appropriate to use smaller wraps for the upper limbs.

The combination of low-load exercise and BFR has been shown to be safe and effective across a variety of populations. Recently, work has been completed to suggest that a practical model of BFR which uses elastic wraps may also be efficacious for those who do not have access to specialized devices (10,11,17). More research is needed on this practical model, but the research thus far is promising.

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FIGURES 1A AND 1B. EXAMPLES OF BFR WRAPS

Figures 1A and 1B are examples of what practical blood flow restriction (BFR) looks like when applied. Figure 1A shows a lower body practical BFR applied using a 7.6 cm wide wrap. Figure 1B shows an upper body practical BFR applied using an approximate 4 cm wide wrap.

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NUTRITIONAL STRATEGIES FOR THE ATHLETE WITH DIABETES

VIRGINIA FISHER AND DEBRA WEIN, MS, RD, LDN, NSCA-CPT,*D

Exercising with type 1 diabetes can be a challenging process for both athletes and trainers. Symptoms associated with exercise such as hypo- and hyperglycemia may result immediately following exercise or even as long as 15 hours post-exercise (3). Therefore, it is important for both athletes and trainers to recognize the benefits associated with exercise as well as acknowledge the most effective strategies to minimize the risks associated with exercising with type 1 diabetes.

RESISTANCE VS. AEROBIC EXERCISE

Previous research has shown that “physical activity must be integrated into diabetes management for its numerous benefits,” including “the potential to improve long-term glycemic control” and to reduce insulin requirements (1,2). While the fear of becoming hypoglycemic may inhibit athletes to push themselves to their uppermost limits, recent studies have shown that the type of exercise performed has an influence on how and when low blood sugar may occur. A study conducted in the Human and Environmental Physiology Research Unit at the University of Ottawa tested the effects of resistance and aerobic exercise on blood glucose levels in type 1 diabetics. Results found that resistance exercise fostered a gradual decline in blood glucose, whereas aerobic exercise caused a rapid decline in blood glucose (6). The study also found that during the recovery phase, resistance exercisers had stable glucose levels while aerobic exercisers had increased glucose levels (6).

A similar study from the same researchers found that performing resistance exercise prior to aerobic exercise results in “attenuated declines in glucose concentration during exercise, fewer exercise-induced hypoglycemic events, and less need for carbohydrate supplementation,” (7). The researchers concluded that performing high-intensity exercise by utilizing the addition of resistance training prior to aerobic exercise not only decreased hypoglycemia effects during exercise, but also was effective in reducing the duration and severity of hypoglycemia over 12 hr post-exercise by increasing the rate of glucose appearance to a greater extent than the rate of glucose utilization (7). Therefore, athletes with diabetes should be conscious of performing a combination of resistance and aerobic exercise.

MACRONUTRIENT REQUIREMENTS

Current research shows that fuel requirements prior to exercise should be determined by the type, duration, and intensity of exercise performed (3). Carbohydrate (CHO) intake during exercise has shown to maintain blood glucose levels and improve performance in athletes (4). A recent literature review suggests that CHO intake has beneficial effects on high-intensity exercise for a duration of 30 – 60 min while 30 – 60 g of carbohydrate per hour of exercise are recommended for events lasting one to three hours (1). Endurance exercise lasting longer than 3 hr may require a combination of energy sources such as glucose and fructose to maximize the level of glucose present in the blood (1). Current research also suggests that, a 15 – 30 g CHO snack may be required during exercise if blood glucose levels are below 7 mmol/l (3). Table 1 provides examples of carbohydrate values in certain foods.

While more research is needed on the benefits of carbohydrate loading in athletes with type 1 diabetes, current research shows that carbohydrate loading should be discouraged in diabetic athletes due to increased insulin requirements and difficulty avoiding hyperglycemia. Instead, athletes with diabetes should consume a “fairly consistent CHO intake of at least 7 g of CHO/kg/day” to maintain muscle glycogen stores (3).

In order for the body to process macronutrients properly, it is important to acknowledge the timing of insulin injections in athletes with type 1 diabetes before exercise. While previous recommendations show that insulin should not be administered within 2 hr of exercise, a recent study suggests that the combination of a 75% reduction in fast-acting insulin can be effective in maintaining blood glucose levels throughout aerobic exercise (1).

While recommendations for pre-workout fuel for general athletes consist of a snack or meal “low in fat and fiber...high in carbohydrates...[and] moderate in protein,” current research shows that a pre-workout snack consisting of low-glycemic carbohydrate administered 30 min prior to exercise is effective in preventing hyperglycemia (1,4). Research has shown that it is pertinent to control blood sugar levels before exercise because exercising with blood glucose levels higher than 10 mmol/l can pose “problems

with regards to performance, [and] is also associated with a shift towards CHO oxidation as the main fuel source compared to when exercising in euglycemia" (normal blood glucose concentration) (3).

Protein recommendations remain the same for diabetic athletes as general athletes. Recommendations also vary based on the type of exercise performed and range from 1.2 – 1.4 g/kg/day for endurance athletes, while recommended protein intake for strength athletes ranges from 1.2 – 1.7 g/kg/day (4).

BOTTOM LINE

Exercising for athletes with type 1 diabetes can be challenging but it is possible to obtain the most from a workout with strategic planning and management of carbohydrate intake, insulin timing, and the proper combination of exercise techniques. Overall, research supports the combination of resistance and aerobic training along with consumption of low and high carbohydrate foods prior to, during, and post-exercise in order to avoid symptoms of hypoglycemia and maximize performance during exercise.

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NUTRITIONAL STRATEGIES FOR THE ATHLETE WITH DIABETES

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**TABLE 1. EXAMPLES OF CARBOHYDRATES
(COMMON SOURCES OF 15 – 30 G)**

	CARBOHYDRATES (GRAMS)
Cereals	
POST® Grape-Nuts (1/4 cup)	23
POST® Shredded Wheat (1/2 cup)	18
Kellogg's® All-Bran® (1 cup)	27
Quaker® Oatmeal (1 oz)	20
Cream of Wheat® (1 oz)	22
Pancakes (2 small)	30
Fruits	
Apple or orange	20
Banana	26
Raisins (1/4 cup)	30
Grapes (1 cup)	16
Apple sauce (1/2 cup)	15
Dried apricots (8 halves)	18
Fruit yogurt (1/2 cup)	25
Others	
Spaghetti (1/2 cup)	20
Winter squash (1/2 cup)	15
Carrots (1, medium)	10
Peas (1/2 cup)	10
Tomato sauce (1/2 cup)	10
Legumes	
Lentils (1/2 cup)	18
Lima beans (1 cup)	28
Garbanzo beans (1/2 cup)	20
Bread Products	
Whole grain (2 slices)	25
Roll (4 in.)	30
Bagel	30
English muffin (1)	25
Corn bread (1 large slice)	29
Graham crackers (2 squares)	11

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DAVE ELLIS, RD, CSCS

Dave Ellis is a Veteran Sports RD and CSCS who has worked in athletics for over three decades! Few have the experience to draw down on when it comes to all the science and trends going on with fueling, including a growing number of security issues for drug tested populations that have arisen from intentional adulteration with active pharmaceutical ingredients! Dave will give us a briefing on these API adulteration trends and what we can do as health professionals to minimize exposures with our athletes.



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LOWER BODY RESISTANCE TRAINING FOR THE ELDERLY POPULATION

CHRIS BEARDSLEY, MA

Elderly people are a potentially large and important source of clients for the personal trainer. However, it is not optimal to train them the same as younger people because elderly people may be generally weaker than their younger counterparts. Since the hips are proportionally more involved in weight-bearing movements, elderly people (classified as over the age of 65) may benefit from an emphasis on training the hips. Lower body resistance training programs can emphasize the hips by training the gluteus maximus and hamstrings first by making best use of the warm-up portion of the workout, using internal cues to increase muscle activation, and ensuring that the exercises used lead to the best possible results.

INTRODUCTION

Aging is associated with reduced functional capacity, an increased risk of falls, diminished strength and muscle mass, lower aerobic capacity, and an increased risk of many lifestyle diseases, including cardiovascular disease and type 2 diabetes (17). Fortunately for this population, and also for the personal trainers who help them, exercise has been found to help reduce many adverse effects of aging and prevent a loss of independence (17). While many guidelines have been published to help elderly people structure appropriate exercise programs, these programs only provide a basic overview. It has been recommended that elderly people performing resistance training complete the following: 8 – 10 exercises of one set of 10 – 15 repetitions twice per week, including exercises for each of the main muscle groups (17). However, individuals who are unfamiliar with exercise, and particularly with resistance training, will likely require assistance to design suitable programs that involve all of the major muscle groups. Further

instruction may be needed on appropriate progression of the program, as these details are not provided in such guidelines.

Lower extremity resistance training is useful for helping to maintain functional capacity, as it relates to the key functions of walking, sit-to-stand, and stair negotiation movements. Since the lower body contains some of the largest muscles in the body, resistance training for this area is important for halting age-related losses of muscle mass, strength, and power (10,13,20). Power is important for maintaining activities of daily living, while higher levels of muscle mass, and strength have been associated with lower mortality rates in the elderly (5,8,18,24). It is the purpose of this short review to provide additional details for personal trainers for how a lower body resistance training program might be designed for healthy elderly people, while still fitting within the current guidelines.

IMPLICATIONS OF WEAKNESS FOR LOWER BODY RESISTANCE TRAINING

Although it is widely known that elderly people are generally weaker than their younger counterparts, what is not as well known is that the mechanics of lower body movements are different between age groups. It is generally assumed that resistance training exercises always require the same contribution of the hip and knee muscles, irrespective of the relative load (i.e., intensity or percentage of one repetition maximum). However, this is not actually the case, as it has recently been examined (3). In fact, as relative loads increase, the ratio of the hip-to-knee involvement for many resistance training exercises such as squats, lunges, and deadlifts increases markedly. Thus, the hip musculature becomes

progressively more important as relative load increases. As a result, elderly individuals are heavily taxed by the performance of functional movements, such as sit-to-stand or stair climbing, and such movements are likely to involve a larger proportion of the hip musculature as compared to younger, stronger individuals.

Indeed, in a study that compared the contribution of the hip and knee musculature in a sit-to-stand movement in young and elderly adults, the older subjects made less use of their knee extensor muscles and more use of the hip extensor muscles, most likely because of their weaker lower limbs (22). Consequently, when designing a lower body resistance training program with elderly individuals, it is logical that a focus on the hip extensor musculature (hamstrings and gluteus maximus) will likely bring about the most rapid improvements in functional capacity.

LOWER BODY RESISTANCE TRAINING

Exercise order

Guidelines for resistance training in elderly individuals currently recommends performing 8 – 10 exercises for one set of 10 – 15 repetitions for each of the major muscle groups (17). However, within these broad parameters, it is still possible to place a greater priority on the hip musculature (hamstrings and gluteus maximus) over the knee (quadriceps) and calf muscles (gastrocnemius and soleus) of the lower body. Exercise order has been found to affect both gains in strength and muscle mass in studies, with exercises placed earlier in a workout displaying greater gains in strength and muscle mass than exercises placed later in a workout (23). Thus, the hip extensor musculature might be emphasized by placing exercises for the hamstrings and gluteus maximus earlier in the workout than those exercises for the quadriceps and calves.

Warm-ups

Warming-up is always recommended prior to any exercise, as it has been found to improve a wide range of performance measures (12). Warm-ups should include three elements: low-intensity aerobic exercise, stretching, and sports or exercise-specific movements (12). There are two ways in which warm-ups could be altered to help contribute to hip muscle development.

The first alteration that could be made is in the low-intensity aerobic exercise section (Table 1). In this section, modalities of exercise could be selected that lead to more activity of the hip extensors than the knee extensors. Lyons et al. reported that the gluteus maximus is more active during stair climbing (or stepping) than during level walking (15). Thus, a stepper might be better than a treadmill as a warm-up for the elderly, whenever tolerable by the client.

Additionally, Rogatzki et al. found that stair stepping and elliptical machine movements produce different levels of gluteus maximus activation; this implies that a warm-up on an elliptical machine would also be useful (21). Thus, for the elderly, both steppers and elliptical machines might be good choices for the low-intensity, aerobic warm-up prior to a lower body resistance training workout.

The second alteration that could be made is in the third section of the warm-up (Table 1). This alteration could be used to contribute indirectly to the development of the hip musculature during the main part of the lower body resistance training workout. This can

be done by including low-load exercises that potentiate hip muscle exercise performance. Potentiation is an effect whereby a previous exercise leads to better performance in a subsequent exercise because the muscle is primed and ready for the movement. Crow et al. found that power output during a countermovement jump was enhanced after performing low-load exercises for the gluteus maximus as part of a dynamic warm-up (7). Exercises that may be beneficial in this respect include the unloaded glute bridge, quadruped hip extension, the prone hip extension with a bent knee (the standard position for testing gluteus maximus function in research studies), and the gluteal squeeze (2,4,7).

Internal cues

During the exercise-specific section of a warm-up, specific internal cues may be helpful in combination with the undemanding, low-load exercises that are intended to potentiate hip muscle exercise performance in the main part of the workout. Internal cues can be thought of as instructions given that direct the client's attention, or focus, to the movement itself. Specifically for the hip musculature, Lewis and Sahrmann found that internal verbal cues to use the gluteals during a prone hip extension exercise led to increased gluteus maximus activation and a simultaneous decrease of hamstrings activation, compared to when no cues were given (14). Also, Oh et al. reported that the use of an abdominal "drawing-in maneuver" during the prone hip extension exercise in order to activate the abdominals led to increased gluteus maximus and hamstrings activation, and reduced lumbar extensor activation; thereby providing elderly clients with cues to focus on contracting their gluteus maximus and abdominal muscles during warm-up exercises (19). Using exercises such as quadruped hip extensions, prone hip extensions, and bodyweight glute bridges may be helpful to enhance performance in the main part of the lower body resistance training workout.

Gluteus maximus training

Few studies have explored the changes in gluteus maximus strength and size as a result of long-term training with different resistance training exercises. Moreover, those studies that have explored the muscle activity of the gluteus maximus during resistance training exercises have been performed with predominantly low-load rehabilitation exercises. However, studies exploring how the muscle activity of the gluteus maximus changes with the joint angle have suggested that neural drive is greatest in full hip extension (11,25). This joint angle corresponds with the point of peak contraction during the hip thrust and glute bridge exercises (6). Therefore, although the hip thrust and glute bridge exercises have not been explored in the literature with additional load, there is a sound underlying basis for using them.

Hamstrings training

A small number of studies have compared hamstrings muscle activity across a range of common resistance training exercises. Exercises found to be beneficial include the glute-ham raise, seated leg curl, lying leg curl, and Romanian deadlift (1,9,16). On the other hand, the squat has been found to be a poor exercise choice for optimizing hamstrings muscle activity by most researchers. Since it is likely that many elderly people will find the glute-ham raise to be too advanced, awkward, and uncomfortable, it seems optimal to begin with a single-leg Romanian deadlift, so long as balance is not an issue. The Romanian deadlift and seated or lying leg curl may be used for the main hamstrings exercises.

LOWER BODY RESISTANCE TRAINING FOR THE ELDERLY POPULATION

CONCLUSIONS

While elderly people are an important source of clients for the personal trainer, it is not optimal to train them the same as younger clients, particularly in respect to lower body resistance training. Since older people are typically weaker than younger individuals, and since the hips are proportionally involved in more weight-bearing movements, older clients will benefit from training the hips over and above the knee muscles. Lower body resistance training programs can place more importance on the hips by training the gluteus maximus and hamstrings first in a workout, making the best use of the warm-up portion of the workout, the careful use of internal cues to increase muscle activation, and by ensuring that the main exercises for the hips are designed for the best results.

SAMPLE PROGRAM

Table 1 provides a simple lower body resistance training program for elderly clients, using the set and repetition scheme provided in the guidance issued by Nelson et al., although many other suitable set and repetition schemes could be equally appropriate (17).

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TABLE 1. SAMPLE PROGRAM (17)

LOW-INTENSITY AEROBIC EXERCISE WARM-UP	MUSCLE TARGETED	DURATION
Either stepper or elliptical machines	Gluteus maximus	5 – 10 minutes
Stretching warm-up	Muscles targeted	Sets and repetitions
Lower body stretches	Hamstrings, quadriceps, calves	1 set of 30 seconds
Dynamic warm-up	Muscle targeted	Sets and repetitions
Quadruped hip extension, prone hip extension with bent leg or gluteal squeeze [with internal cues to contract the gluteus maximus and abdominals]	Gluteus maximus	1 set of 10 – 15 repetitions
MAIN WORKOUT	MUSCLE TARGETED	SETS AND REPETITIONS
Hip thrust or glute bridge	Gluteus maximus	1 set of 10 – 15 repetitions
Single-leg Romanian deadlift, Romanian deadlift, seated leg curl, or lying leg curl	Hamstrings	1 set of 10 – 15 repetitions
Box squat, squat, or leg press	Quadriceps	1 set of 10 – 15 repetitions
Standing calf raise or seated calf raise	Gastrocnemius	1 set of 10 – 15 repetitions



TAKING THE PROPER STEPS TO IMPROVE THE INDUSTRY

ROBERT LINKUL, MS, CSCS,*D, NSCA-CPT,*D

What do medical doctors, dentists, physical therapists, and chiropractors all have in common? They all have a governing body that oversees their professional certification, conduct, status, and ability to perform the duties of their profession. For the purposes of this article, one can presume that the average American goes to the doctor and dentist once or twice a year and the physical therapist or chiropractor maybe once or twice a month, obviously the frequency of these visits will vary based on the individual. The certified personal trainer however, is a different story.

Clients will meet two, three, or even four times a week for regular workout sessions with their certified personal trainer (CPT) yet the personal training industry does not have a governing body. Clients may go twice a year to see their doctor compared to potentially 100 or more times a year to see their personal trainer, yet the disparity between the professional standards for each field is quite large. This leads to the question of why certified personal trainers do not have a governing body.

CPTs likely have more “hands-on” contact with their clients than any other profession, yet there is no governing body present to oversee their professional conduct and standards. CPTs have certifying agencies that encourage them to act in a professional manner and to train clients appropriately; however, they have no mandated requirements other than a high school diploma and a valid cardiopulmonary resuscitation (CPR) certification to earn their personal training certification. The only time these standards are revisited is when the recertification period comes around every two or three years (depending on the agency), which requires trainers to keep current with their continued education.

The certifying agencies attempt to hold their certified professionals to high standards by providing quality, continued education opportunities at conferences and clinics; however, many fitness facilities do not keep track of the CPR and recertification period of their trainers once employed. This often leads to an expired certification and a fitness professional lacking the most recent and updated education required to provide a quality product to their clients.

The committed client deserves to work with an exceptional fitness professional. They invest their hard-earned money and time into training, and the product should match their efforts. Many CPTs earn their certification and simply “start working” with no attempt to improve themselves in any lacking areas or excel in specific areas of expertise. It is the trainer’s professional duty to bring a high-quality product to their client and deliver it in an exceptional way.

The committed trainer deserves to progress through the ranks of the fitness industry as they continue to improve themselves through educational opportunities and application. CPTs that consider training their clients to be a “career” (not a job) have dedicated their efforts to becoming exceptional. They hold themselves to high standards and by doing so, they reap the benefits. Increased pay rate, increased clientele, and an increase in professional respect from within the fitness industry are all benefits of CPTs that are growing their reputations for being career-driven professionals.

The fitness industry is lacking a governing body and, in turn unfortunately, the industry has a reputation for producing some professionals that are below standard. The question becomes, how do we fix it? Until a governing body is established, there is nothing the industry, as a whole, can do. As individual CPTs however, there are many things that can be done to become and remain a highly qualified and exceptional fitness professional:

- **Earn and Maintain a Valid NCCA Accredited Certification**
Certifications accredited by the National Commission for Certifying Agencies (NCCA) are the gold standard for fitness professional certifications. These certification exams are peer-reviewed and written to test the knowledge of the exam being taken and to ensure that the test takers possess the knowledge that was provided within the confines of the learning materials (e.g., textbook, etc.). There are more than 60 certifying agencies available to fitness professionals to choose from; however, only 12 currently carry the NCCA approval with their certification.

- **Maintain Basic Professional Standards at All Times**

Fitness professionals must keep their basic operating standards current. These standards include:

- Maintaining a NCCA accredited certification
- Keeping a valid CPR, automated external defibrillator (AED), and first aid certification
- Obtaining and maintaining professional liability insurance
- Attending continued education opportunities often (suggested frequency: every three months)
- Conducting business in a professional manner (e.g., proper paperwork, scope of practice, etc.)

- **Self-Evaluation of Professional Conduct and Performance**

Fitness professionals need to be able to assess themselves with an honest and open mind. Self-evaluations can be performed to assist in maintaining or improving a professional standard. These evaluations should include the “five Ps:”

- Professionalism (are you prompted and prepared for every client; are you in uniform; are workouts prepared ahead of time; are you focused on your client for their entire session, etc.)
- Program design (are you creating program designs ahead of time; are they specific to the needs of the client; are you keeping records of all their workouts; are they achieving their goals, etc.)
- Professional and personal relationships (are you communicating well with the client; are you greeting your clients with energy; are you showing genuine interest in their needs; are you empathetic yet stern to hold them to standards, etc.)
- Professional development (are you actively trying to improve yourself; are you focused on developing areas of weakness and increasing areas of strength; are you meeting CEU requirements; are you becoming an expert in your field, etc.)
- Personal development (are you allowing yourself enough time off; are you focusing on achieving financial goals [e.g., savings, retirement, etc.]; are you making sure to not overwork or overtrain, etc.)

- **Earn a Secondary Certification**

- Statistics show that CPTs with a secondary certification can make more annual income compared to trainers who do not (1). Obtaining a secondary certification brings a level of expertise and higher learning to the trainer’s name and reputation. Trainers who develop and build a reputation for excelling at their specialty are highly sought after by consumers.

- **Focus on Business Education**

- Most CPTs spend countless hours learning how to train clients and produce results. They build a successful following of clients and then decide to branch off and go into business for themselves. They open a gym or personal training studio and start working as an independent business owner. The problem then becomes having little or no business experience. The trainer starts off well because their business is new and their current clientele feeds them referrals; however, as clients start to drop out, the financial situation becomes clear. Some trainers lack the business knowledge to stay in business.
- It is important to attend some business conferences, business mentorship programs, or business classes to learn how to start, maintain, and grow a business successfully for personal trainers looking to branch off on their own. Personal trainers are often forced to leave the field after just a few years, which can often be attributed to the inability to market to and keep clients, as well as operate a business successfully. Improving business education may help personal trainers remain successful in the field.

These suggestions will assist the certified personal trainer in building their reputation as a career-driven professional, as well as improving the quality of the product they produce and maintaining a financially sound business. As with any “good” suggestion, it comes down to the practitioner actually putting these ideas into action for them to work well.

With the lacking presence of a governing body, it is up to each individual trainer to be self motivated and to develop the “wanting need” to hold themselves to these high standards. An honest and thorough self-evaluation is one of the best tools a CPT can use to gain an objective overview of their abilities. It is important to identify what strengths and weaknesses are present and then take action toward growing or improving them.

If every certified personal trainer can elevate their professional work ability on a regular basis and take the proper steps toward improving, then the industry may begin to improve, as a whole. Trainers who take the time and make the investment to improve themselves will not only see financial growth but also an increase in their reputation and professional ability.

These are some of the important steps toward becoming an elite, certified personal trainer. Taking these steps toward professional growth will qualify a certified personal trainer to be able to say, “I am no longer part of the problem, I am part of the solution.”

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TAKING THE PROPER STEPS TO IMPROVE THE INDUSTRY

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BOTTOMS UP — KETTLEBELL EXERCISES

MATT SZELOG, ATC, CSCS

It is no wonder why the use of kettlebells in our resistance training programs has increased over the past few years. Kettlebells offer a wide variety of exercise variations with a weight distribution different than dumbbells. This variation places different demands on muscle tissue, joint stabilizers, core engagement, grip strength, and wrist strength. This article will review some of the most beneficial exercises that involve the “bottoms up” kettlebell approach with traditional dumbbell movements.

WHAT IS BOTTOMS UP?

The term “bottoms up” refers to when a kettlebell is used with the belly of the weight upside down or when the grip of the kettlebell is facing down. This approach has a significant degree of difficulty compared to dumbbells and regularly gripped kettlebell exercises. By simply turning the kettlebell upside down, it creates a new center of gravity, which results in decreased stability of the weight. This forces clients to utilize more grip strength and wrist strength, and to incorporate more stability through proximal and distal joints.

As with any exercises that are prescribed to clients, it is important to demonstrate form and make sure the correct resistance is indicated. Because the bottoms up approach is more difficult, it is suggested to start with lighter weights until clients demonstrate that they are prepared to progress. It is common to find a very noticeable difference in the non-dominant side of the body; which, with time, adjusts and allows for an increase in weight if progressed properly.

EXERCISES

BOTTOMS UP OVERHEAD PRESS

There are multiple options for the starting position including half kneeling, kneeling, or standing, as well as unilateral or bilateral. Figure 1 depicts the standing exercise using unilateral movements. Start by standing with the feet shoulder-width apart. While standing, bend the knees to prevent swaying or leaning back and brace the core to provide a solid foundation. Place the bottoms up kettlebell in the right hand, while bringing the humerus into 90 degrees of flexion and the elbow at 90 degrees of flexion. Make sure the arm is tucked in towards the chest so that the elbow is in perfect alignment with the armpit. As the weight remains upside down, press up and extend the arm overhead while maintaining retraction of the scapula. Slowly lower and repeat on both sides.

BOTTOMS UP CARRY

Begin by placing the kettlebell in the same position as the overhead press. Unlike the press, the goal of this exercise is to maintain an isometric contraction of the 90/90 position—there is no concentric contraction. While isometrically holding the weight, choose an appropriate distance to walk. Keep the weight stable and repeat for the desired amount of steps or time before switching hands. Holding the kettlebell while moving the rest of the body will increase demands on shoulder and scapular stability.

BOTTOMS UP WAITER WALK

Start with an overhead press movement, holding the kettlebell isometrically in complete shoulder flexion. It is essential that the arm be fully extended with the shoulder blade pulled back. The arm should be at 180 degrees or closely aligned with the ear.

While maintaining this hold, begin walking. As with the kettlebell carry, a high amount of shoulder and scapular stability will be required to perform this exercise. Switch hands and repeat.

BOTTOMS UP CHEST PRESS

Start by lying supine on a bench and maintain the five points of body contact (feet, buttocks, back, and head). Have a partner place two bottoms up kettlebells in your hands. Begin the concentric movement like a traditional chest press. Once the weights are together at the top of the motion, slowly lower them back to just above chest level. Please note that using a spotter is always needed due to the high probability that the kettlebells will shift or fall.

BOTTOMS UP SIT-UP

Start completely supine with a bottoms up kettlebell in one arm. Hold the kettlebell directly above the body with the shoulder flexed to 90 degrees and the arm perpendicular to the body. Begin the exercise by contracting the core and driving the torso (above the waist) upward. While performing the sit-up, the arm holding the kettlebell will simultaneously go into full flexion. The exercise is finished when the body is sitting straight up and the kettlebell is overhead. Slowly lower and repeat. This exercise may help in developing stability and strength.

BOTTOMS UP FRONT SHOULDER RAISE

Start by standing with the knees slightly bent and a slight retraction of the scapula. The starting position for the kettlebells varies slightly because of the bottom up position, but the dorsal region of the wrist should be under the kettlebell itself. With the elbows completely locked out, raise the arms forward to 90 degrees of flexion. Keep the upper trapezius relaxed and the shoulder blades back. Slowly lower and repeat.

Again, it is important to begin each exercise with a lighter weight. It may be useful to promote unilateral work so that strength deficits for non-dominant sides can be seen clearly. Spotting for these exercises is highly recommended due to three reasons: most are overhead, they are new movements with a high probability of dropping the weights, and wrist strength deficits will cause the weight to flip more times than not. These exercise variations could be a great addition to any client's strength and conditioning program, not only because they are something new, but because they also add an increased demand on muscular strength and muscle/joint stability. There are numerous other exercises with the bottoms up approach that could be added, but these exercises make for a great starting point.

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Matt Szelog is the Sports Performance Coordinator at the Athletic Performance Center of Exeter Hospital. Over his 12-year career, he has worked with numerous youth, high school, college, adult, and professional athletes both in the strength and conditioning field and as an athletic trainer. He develops and implements sports performance training which builds each athlete's foundation to ensure proper progression and athletic development. He also specializes in sports performance training, injury prevention training, corrective exercise techniques, and post-rehabilitation training.

BOTTOMS UP — KETTLEBELL EXERCISES



FIGURE 1. STARTING POSITION FOR THE OVERHEAD PRESS AND POSITION FOR BOTTOMS UP CARRY



FIGURE 2. FINISHING POSITION OF THE OVERHEAD PRESS AND POSITION FOR THE WAITER WALK



FIGURE 3. STARTING POSITION FOR THE CHEST PRESS



FIGURE 4. FINISHING POSITION FOR THE CHEST PRESS



FIGURE 5. STARTING POSITION FOR THE BOTTOMS UP SIT-UP



FIGURE 6. FINISHING POSITION FOR THE BOTTOMS UP SIT-UP



FIGURE 7. STARTING POSITION FOR THE BOTTOMS UP FRONT SHOULDER RAISE



FIGURE 8. FINISHING POSITION FOR THE BOTTOMS UP FRONT SHOULDER RAISE

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AGE APPROPRIATE FITNESS CONSIDERATIONS FOR THE OLDER FITNESS CLIENT

KEITH CHITTENDEN, MS, CSCS, TSAC-F

One growing group of fitness clientele is the aging “baby boomers” generation. This large population is in need of fitness services commonly—possibly more than any other population. As the human body ages, many changes take place, such as muscle atrophy (known as sarcopenia), diminished bone density (osteoporosis), and a possible decline in mental focus and memory. Exercise may help slow the progression of these changes over time.

One potentially beneficial form of exercise for an individual 65 years of age or older (cleared by a physician) is resistance training. Resistance training for older adults has been shown to be the most important intervention for sarcopenia (1). Resistance training has been shown to be safe and effective at increasing muscular strength, endurance, flexibility, neuromuscular efficiency, and bone density (2,5). Resistance training can enhance performance, decrease stress on joints, decrease the risk of falls, normalize blood pressure, prevent bone loss, reduce insulin resistance, increase bone mineral density, increase strength of connective tissues and tendons, and increase lean muscle mass (2,4,5).

Resistance training has the following variables that are important to consider: external load/resistance, sets, repetitions, intensity, and rest. There will be a difference in intensity, sets, and repetitions between a 45-year-old, 65-year-old, and 85-year-old person. For example, a 45-year-old (healthy individual without any presence of disease) should be able to engage in strength training at a higher intensity than someone who is older because of the presence of greater muscle mass and muscle fiber density (5,6).

Strength and endurance levels are typically higher for a person in their mid 40s than in their 60s or 80s. Individuals in their 60s, 70s, and 80s have an overall decrease in rate of contraction and a decreased ability to create muscle power during activities (2,5).

A person that is 65 years old would benefit from an exercise program that includes low-to-moderate resistance training (40 – 60% 1RM) 2 – 3 times a week for 2 – 3 sets of 10 – 12 repetitions with a minimum of 20 min per exercise bout (6). A patient that is 85 years old would benefit from an exercise program that includes low-to-moderate resistance training (40 – 60% 1RM) 1 – 2 times a week for 2 – 3 sets of 8 – 12 repetitions with a minimum of 20 min per exercise bout (2,5,6). The goal for a 65-year-old and 85-year-old patient would be muscular endurance and maintenance, and sparing of lean muscle mass (6). An individual that is 45 years old would benefit from an exercise program that includes a moderate intensity resistance program (55 – 90% 1RM) 3 – 5 times a week for 2 – 3 sets of 10 – 12 repetitions with 20 – 60 min per exercise bout.

After 4 – 5 months of resistance training, an older individual may be able to increase their ability in activities of daily living (ADLs), increase gait speed, improve balance, and decrease the risk of falls and injury (2,4). Despite studies that have shown that resistance training is safe for older adults, several variables in the resistance program planning must be considered. As individuals age, their bone density decreases; therefore, heavy intensity (> 80% of 1RM) and maximal loads of external resistance should not be used (2,5). According to studies, an intensity of 40 – 50% of 1RM showed significant strength gains in older adults (2,4,5,6).

An alternative to using heavy external loads (barbells, dumbbells) is aquatic training (3). Using a swimming pool can give an older adult enough resistance to gain the benefits of resistance training without the risk of injury from heavy external loads, such as from dumbbells or barbells (3). In aquatic training, the resistance that the older client uses is buoyancy and drag (3). Buoyancy decreases the stress for those older adults that suffer from osteoarthritis in weight-bearing joints (e.g., hips, knees, etc.). It also increases the upward force on the body as the person is further immersed. Buoyancy can also provide an external resistance as the person pushes or pulls down, such as in a squat movement (3). Another resistance in the water is drag; as an individual moves forward (e.g., walking, swimming, and running) the drag is the resistance that pushes back on the person (3). As the individual's velocity, surface area, and inertia are increased, the drag force proportionally increases.

It is vitally important that the certified fitness professional assess the needs of the client in his/her ability to carry out activities that are important to them functionally. For an older client, the use of resistance training, endurance training, and aquatic training can enhance their exercise experience. The fitness professional must determine the proper intensity, volume, and mode of exercise that will best accommodate their client. It is important that the program be specific and customized (i.e., adjusted for time constraints, level of fitness, and foreseeable setbacks) to that client's abilities and needs. Lastly, it is important that the client be motivated to exercise. Fitness professionals need to engage their clients in a manner that is enjoyable, challenging, and progressive so that the client can see and feel the results in their everyday lives.

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METABOLIC SYNDROME, GUT HORMONES, AND EXERCISE: WHERE DOES PERSONAL TRAINING FIT IN?

REBECCA COOPER, MA, NSCA-CPT

Clients of personal trainers often differ from clients of athletic coaches, especially those clients over the age of 45. Personal training clients are often detrained and suffer from comorbidities such as diabetes, high blood pressure, low high-density lipoprotein (HDL) cholesterol, obesity, and a body mass index (BMI) of over 30. Grouped together, these risk factors are referred to as metabolic syndrome. There are many reasons why people develop risk factors that lead to metabolic syndrome (e.g., genetic, environmental, lifestyle behaviors, etc.). We know that exercise has a positive effect on all risk factors, but reducing body fat percentages in people with metabolic syndrome to a level that is considered “normal” is often elusive.

Training these clients effectively can prove challenging for personal trainers, and for good reason. While exercise can improve the status of these risk factors, it is not just a matter of “calories in, calories out.” A person with a BMI of over 30 often feels hungry; in fact, they often feel hungrier than those with BMI levels that fall into a normal range (19.5 – 24).

Research in the past 15 years has focused on the relationship of people suffering from metabolic syndrome and the gut peptides, ghrelin and leptin. Leptin was discovered in 1994 by Dr. Jeffrey Friedman and ghrelin was discovered in 1999 by Dr. Masayasu Kojima. Both leptin and ghrelin respond to how well-fed an individual is and their signals become deregulated when one is obese (4).

Leptin is the gut peptide hormone produced by fat cells and signals the brain that a person is full, and thus is referred to as the satiety hormone. Obese people have more circulating leptin

and therefore one would assume that persons with BMIs over 30 would eat less, because their bodies are telling their brain that they are satiated. This paradox has proven a challenge for scientists who now theorize that obese persons have become leptin resistant, much the same way that type 2 diabetics are insulin resistant. For some obese people, the brain is not getting the signal that they are full; therefore, obese people are often more hungry than those who are not.

Ghrelin is one of the major gut peptide hormones responsible for hunger, and is produced primarily in the stomach and proximal small intestine. Circulating concentrations of ghrelin peak during fasting, drop after a meal, and are involved in hunger (5). Ghrelin signals the hypothalamus that a person is hungry. People with more circulating ghrelin may find high fat and high sugary foods more appealing. Scientists refer to ghrelin as orexigenic (a substance that stimulates a person’s appetite). Ghrelin has other effects in the human body as well, such as acting as a motility agent for digestion.

Gastroenterologists have observed that persons who recover from bariatric surgery, particularly Roux-en-Y and gastric sleeve bypasses have ghrelin and leptin levels that are found in persons with a normal BMI (4). A high percentage of patients who go into bariatric surgery as diabetic patients have normal blood glucose levels post-operation. “Band-type” surgery, which modifies the size of the stomach, does not affect ghrelin, leptin, and insulin levels in the body, and does not offer the same benefits of Roux-en-Y or sleeve gastrectomy surgery (2).

Not everyone with a high BMI is a candidate for or can afford bariatric surgery. An alternative option is a standard diet and exercise routine. However, what impact does exercise have on ghrelin and leptin levels in people with normal BMIs versus those with BMIs greater than 30? It is known that ghrelin levels are suppressed up to two hours immediately following exercise, which suppresses hunger and in turn, can help reduce caloric intake (6).

Because ghrelin levels rise before a meal and fall after a meal, it is easier to measure this appetite hormone and response to exercise. It is more difficult to assess the immediate impact that exercise has on leptin levels. Leptin is dependent upon body fat percentage; as body fat is reduced, leptin levels will return to normal (1).

There are many challenges for researchers studying obesity and metabolic syndrome. The variables in patients are sex, age, and pre-menopause versus post-menopause in women. A clinical trial done at the University of Wyoming and the University of Washington looked at the hormonal regulators of appetite in young, healthy women who walked for 60 min versus women who ran for 60 min (5). The women were allowed to eat ad libitum (at their own discretion) during the trial, which included studies post-exercise and following rest. The research demonstrated that circulating ghrelin levels were higher in runners versus the walkers; though all participants showed higher levels of ghrelin post-exercise versus after rest. However, the interesting finding that offers insight for personal trainers is that after adjusting for the cost of exercise or rest, relative energy intake was lower following exercise to rest in both groups (5). Even though the level of ghrelin was higher, the energy intake was lower following exercise. The researchers theorized that while exercise induced higher circulating ghrelin levels, the effect of ghrelin was muted by other complex changes in appetite regulating hormones as a response to exercise. The researchers also observed that walking did not elicit the same negative energy balance as did running, and suggested that walking may create some challenges for long-term weight loss unless dietary restriction is employed (5).

Another clinical trial studied the effects of exercise on hormones in obese men. The researchers hypothesized that an intermittent exercise protocol with a progressive intensity would cause a temporary suppression of ghrelin concentrations and hunger levels in obese men. Ten obese college students (BMI > 30) who were otherwise healthy participated in the study. The protocol called for intermittent treadmill running that increased in intensity (approximately 70% of VO_2max). The results showed that ghrelin and hunger sensations of inactive obese men were suppressed in response to intermittent treadmill running and remained suppressed for two hours post-exercise (3).

There seems to be evidence that exercise does play a role in suppressing appetite and burning calories in obese but otherwise healthy subjects. However, the extent of how hunger suppression is realized via exercise depends on the intensity of the exercise and the age, weight, and sex of the individual. A review article notes that the majority of studies have shown that acute exercise does not increase hunger, and in fact, acute exercise (cycling or running) has been found to reduce hunger significantly (4). Interestingly, research shows that men often do not increase their

food intake with increased exercise, but normal weight women did increase their food intake in response to exercise (4). However, obese women did not have an increase in food intake after a three-day exercise intervention. Immediate benefits of exercise for persons with metabolic syndrome are reduced blood pressure, improved glucose levels, and an increase in HDL cholesterol (6). It must be remembered that regular exercise is associated with substantial reduction in total and visceral fat and in skeletal muscle lipids (6).

In some of the research presented above, the subjects were relatively young. In some of the studies, subjects were obese but did not have all the risk factors that collectively form metabolic syndrome. Adjustments for age and overall condition of a client who is older must be made. A detrained person over 45 years old with metabolic syndrome may become easily discouraged and may perceive any exercise as intense initially. The articles cited used intermittent, progressive exercise programs with scheduled rest periods, and had positive results in curbing appetite and reducing food intake. In designing programs for clients with metabolic syndrome, adopting progressive interval training, initially on the treadmill or stationary bike, should prove effective in suppressing hunger while increasing endurance. Strength training with resistance bands and bodyweight is a good starting place for untrained or detrained clients. It is important to have patience and realistic expectations for outcomes. Compassion, support, and understanding will help clients stay committed to a long-term goal that may ultimately improve their overall health.

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Rebecca Cooper graduated from Villanova University in 2000 with Bachelor's degrees in History and French and earned her Master's degree in 2004. Recently, Cooper works in marketing for biotech companies in the gastroenterology therapeutic area and attends many medical conferences focused on gastrointestinal issues. She is participating in the Human Gut project, which is studying the microbiome and its effects on digestion, obesity, and inflammation.



SPEED AND AGILITY TRAINING OUTDOORS

CHAT WILLIAMS, MS, CSCS,*D, CSPS, NSCA-CPT,*D, FNSCA

As spring and summer approach, personal trainers are provided the opportunity to incorporate more drills and exercises in an outside environment. Including speed and agility drills is a great way to change up the program design, enhance creativity, and challenge motor skill development.

There are six motor skill variables that can be challenged and improved when adding agility drills into a training program (1,2):

1. Agility is the ability of an individual to change direction (quickly) or velocity of the body due to a stimulus
2. Balance is the ability to maintain the body's position over a fixed base of support (static) or while the body is in movement or challenged by a base of support that is changing (dynamic)
3. Coordination is the ability to move through a complex set of movements while maintaining balance
4. Power is the rate at which work is performed or the amount of work performed in a given time
5. Reaction time is the ability to react to a stimulus involving the senses, usually auditory or visual in regards to sport
6. Speed is the ability to cover a distance or perform a movement in a short amount of time

AGILITY DRILLS

Four Cone Drill (Sprint, Shuffle, Backpedal, Shuffle) (Figures 1-3)

For this drill, the four cones can be placed 3 – 5 yards apart or whatever distance is desired to meet the client's needs. Starting at one corner, sprint to the cone directly in front (Figure 1), cut sharply to the right and shuffle to the next cone (Figure 2), change direction into a backpedal (Figure 3), and cut at the last cone into a shuffle. Variations can be added by changing up the skills at each cone.

FIGURE 1. SPRINT FORWARD (CONE 1 TO CONE 2)



FIGURE 2. SHUFFLE RIGHT (CONE 2 TO CONE 3)



FIGURE 3. BACKPEDAL (CONE 3 TO CONE 4)



Four Cone Drill: Zig Zag (Figures 4 and 5)

This is a variation that changes up the pattern for the four cone drill. Starting at cone 1, sprint diagonally to cone 3 (Figure 4), then decelerate and change direction into a backpedal to cone 4 (Figure 5). Change direction and accelerate into a sprint diagonally to cone 2 and finish up with a backpedal to return back to cone 1.

FIGURE 4. SPRINT DIAGONALLY (CONE 1 TO CONE 3)



FIGURE 5. BACKPEDAL (CONE 3 TO CONE 4)



Sprint – Shuffle – Sprint Drill (Figures 6-8)

Three cones are set up five yards apart, the same as a pro-agility test. The individual will start at the first cone and sprint to the second cone (Figure 6), then shuffle to the third cone (Figure 7), and decelerate and immediately start accelerating into a sprint back through the second cone (Figure 8).

FIGURE 6. SPRINTING (CONE 1 TO CONE 2)



FIGURE 7. SHUFFLE (CONE 2 TO CONE 3)



FIGURE 8. ACCELERATE AND SPRINT (CONE 3 THROUGH CONE 2)



SPEED AND AGILITY TRAINING OUTDOORS

Y-Drill (Figures 9-12)

The Y-drill uses a configuration of cones in a “Y” shape (Figure 9). Start with a shuffle from cone 1 to cone 2 (Figure 10). Then perform a change of direction by opening up the hips and sprinting from cone 2 to cone 3 (Figure 11). Decelerate and backpedal from cone 3 back to cone 2 (Figure 12), then perform another change of direction to sprint from cone 2 to cone 4. Decelerate at cone 4 and backpedal back to cone 2. Then open up the hips and shuffle back to the start at cone 1. Be sure to alternate sides when performing the shuffling actions.

FIGURE 9. Y-DRILL SETUP



FIGURE 10. SHUFFLE (CONE 1 TO CONE 2)



FIGURE 11. SPRINT (CONE 2 TO CONE 3)



FIGURE 12. BACKPEDAL (CONE 3 TO CONE 2)



W-Drill (Figures 13-16)

For the W-drill, cones are set up in the shape of a “W” (Figure 13). Start at the top left cone (cone 1) and backpedal with a slight diagonal path to the bottom left cone (cone 2) (Figure 14). Decelerate and quickly accelerate into a sprint to cone 3 located at the top in the center (Figure 15). From cone 3, decelerate and backpedal to the back right cone (cone 4) (Figure 16), and then again decelerate and promptly accelerate into a sprint to finish the drill at the top right cone (cone 5). This drill can be modified by starting with a sprint or incorporating all shuffles from cone to cone.

FIGURE 13. W-DRILL SETUP**FIGURE 14. BACKPEDAL (CONE 1 TO CONE 2)****FIGURE 15. SPRINT (CONE 2 TO CONE 3)****FIGURE 16. BACKPEDAL (CONE 3 TO CONE 4)**

SPEED AND AGILITY TRAINING OUTDOORS

Open Agility Drill: Circle of Colors Reaction (Figures 17-19)

Begin in the middle of a circle with multiple colored dots or cones surrounding the individual (Figure 17). The trainer will yell out a different color and the individual will shuffle quickly to the color called (white, for example) and then return to the center (Figure 18). As they approach the center, the trainer will call out a different color so that they have to react swiftly, change direction, and shuffle to the next color (red, for example) (Figure 19). This drill can be modified by incorporating sprints, backpedals, or combining all three movements.

FIGURE 17. SETUP AND START



FIGURE 18. SHUFFLE (TO THE WHITE CONE)



FIGURE 19. SHUFFLE (TO THE RED CONE)



Four Hurdle Square (Figures 20-22)

Start in the middle of the square (Figure 20) and complete jumps to the outside of each hurdle (Figure 21) returning back to the center each time. This should be done as quickly as possible: decelerating, reloading, and explosively returning back to the center under control. The individual should jump laterally left and right, forward, and backward. There is no specific pattern but it can be performed in a clockwise or counter-clockwise sequence.

FIGURE 20. STARTING POSITION



FIGURE 21. JUMP



FIGURE 22. LANDING



Four Hurdle Weave (Figures 23-26)

The four hurdle weave incorporates lateral jumps moving left and right with weaves in and out of the hurdles while executing forward and backpedaling. Start at either end of the hurdles and jump laterally as quickly as possible over the hurdles. After the last hurdle, change direction and jump laterally back the other way. Once the jumps are performed down and back, then begin the weave with either a forward or backpedal, one repetition of the drill is finished once the weave is completed down and back.

FIGURE 23. LATERAL JUMPS**FIGURE 24. LATERAL JUMPS****FIGURE 25. FORWARD****FIGURE 26. DECELERATING AND BACKPEDALING****REFERENCES**

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QUALITY

Not all proteins are equal for muscle protein synthesis – quality matters! For example, whey protein is a high-quality, complete protein containing all of the EAA* and high levels of BCAA.**

BCAA Content of Foods

	Leucine	Isoleucine	Valine
1 scoop (36 g) whey protein isolate†	4.7 g	2.1 g	1.9 g
1 scoop (36 g) soy protein isolate	2.4 g	1.5 g	1.5 g
3.5 oz sirloin steak	2.3 g	1.3 g	1.4 g
3.5 oz chicken breast	2.5 g	1.5 g	1.6 g
1 cup low-fat yogurt	1.3 g	0.7 g	1.1 g
1 cup skim milk	0.9 g	0.5 g	0.6 g
1 egg	0.5 g	0.3 g	0.4 g
2 tbsp peanut butter	0.5 g	0.2 g	0.2 g

USDA National Nutrient Database for Standard Reference, Release 26

†USDEC Reference Manual for U.S. Whey and Lactose Products



VERSATILITY

Whey protein can easily be added to a variety of foods and recipes. More whey recipes can be found at www.wheyprotein.nationaldairycouncil.org/recipes.

- Stir into hot foods (not boiling), such as soups, pasta sauces and stews immediately after cooking
- Use as an ingredient in baked goods
- Include in savory or sweet dips
- Stir into hot cereal or creamy sauces
- Add to peanut or other nut butters



TIMING

Add high-quality protein, such as whey protein, to meals and snacks to boost protein intake. Some experts suggest 20-35 g at each meal to help maintain muscle. Here are a few ideas:

Breakfast

Berry Smoothie:
Nonfat Greek yogurt,
frozen berries,
banana, ice +
3 tbsp
vanilla
whey
protein
powder



Lunch

Tomato soup +
2 tbsp whey protein
powder, whole
wheat toast with low-
fat cheese, apple



Snack

Carrots and whole
wheat pretzels,
reduced fat ranch
dressing + 2 tbsp
whey protein powder



Dinner

Whole wheat pasta,
marinara sauce +
3 tbsp whey protein
powder, spinach salad
with Italian dressing



**Include protein after
exercise to help with
muscle recovery!**



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For more information and recipes, visit us at www.wheyprotein.nationaldairycouncil.org.

Refer to your registered dietitian or healthcare provider for specific meal and calorie recommendations.