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Conditioning Fundamentals

Features

Eccentric Training for Distance Runners
Juan Gonzalez, PhD, CSCS, HFI

Flexibility Training: Incorporating All Components of Fitness
*Chat Williams, MS, CSCS,*D, NSCA-CPT,*D*

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about this PUBLICATION

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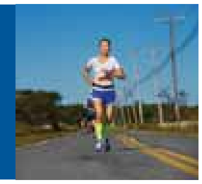

departments

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Want to Improve Acceleration and Repeated Sprint Performance? Should You Train Speed Agility or Sprint Intervals?

When working with team sports it has been well documented that factors such as speed and repeated sprint ability can contribute significantly to competitive success. The ability to craft an effective training program which has the ability to improve these performance characteristics is of particular interest to the strength and conditioning professional. Two possible strategies that can be used to enhance these characteristics are the use of speed and agility work and repeated sprint interval training. Repeated sprint interval training has the ability to significantly alter muscle metabolism while simultaneously stressing both aerobic and anaerobic energy systems. Additionally, repeated sprint interval training has been suggested to enhance overall speed development. Conversely, it may be warranted to work on speed and agility as it may result in improvements in repeated sprint performance. Recently, this question was addressed by researchers from France, where the effects of four weeks of sprint and agility (S/A) training was compared to the training effects stimulated by sprint interval training (SIT). A total of 18 well-trained adolescent handball players were divided into one of two training intervention groups (S/A or SIT). The S/A group performed 3 – 4 series of 4 – 6 exercises (agility drills, standing start and very short sprints, all performed for < 5secs). Each repetition was interspersed with a 30-second passive recovery, while each set was interspersed by three minutes of passive rest. The SIT group performed 3 – 5 repetitions of 30-second all-out shuttle sprints over 40m, with two minutes of passive recovery between repetitions. Pre and post-training intervention performance tests included a countermovement vertical jump assessment, 10m sprint, a repeated sprint agility test, and a graded intermittent aerobic test. The S/A training intervention resulted in a greater increase in 10m sprint performance (+2.2%) and repeated sprint ability (+2.2%) which was greater than the SIT intervention. Conversely, the SIT group resulted in significantly greater improvements in performance during the grade intermittent aerobic test (-5.2%) when compared to the S/A intervention. As a whole, it was concluded that SIT training resulted in a moderate improvement in intermittent endurance capacity, while S/A training is likely to result in greater improvements in acceleration and repeated sprint performance. The authors suggest that targeting repeated sprint ability may not be the optimal method and that focusing on acceleration based training may be more effective.

Buchheit, M, Mendez-Villanueva, A, Quod, M, Quesnel, T, and Ahmaidi, S. Improving acceleration and repeated sprint ability in well-trained adolescent handball players: Speed versus sprint interval training. *Int J Sports Physiol Perform* 5: 152 – 164, 2010.

Does Sprint Training Improve Both Aerobic and Anaerobic Performance?

Recent literature suggests that sprint interval training has the ability to enhance many of the biochemical and physiological systems associated with aerobic activities, as well as improve anaerobic performance. However, most of this literature has used 4 – 6 repeated, all-out 30-second efforts separated by four minutes of recovery. The benefits of these types of sprints may come from one of three possible sources: 1) the first 10secs of activity where peak power output occurs, 2) the attempted maintenance of peak power output over 30secs, or 3) the length of the recovery between bouts. To determine which factors affect the adaptive responses to these types of activities, researchers from The University of Western Ontario examined different combinations of sprint durations and rest intervals. Forty-eight young adults were recruited to participate in the present investigation. The subjects were divided into one of three treatment groups [exercise time (secs): recovery time (mins)]: 1) 30:4, 2) 10:4, 3) 10:2, or 4) control group which performed no training. The three training groups performed three training sessions per week, while the control group performed no training across the 2-week intervention period. All interventions were performed on a cycle ergometer against a 100g/kg body mass load starting at four bouts per session and increasing by one bout every two sessions until six bouts per session were achieved. Pre- and Post testing included assessments of body composition, maximal aerobic power, 5km time trial performance, and anaerobic power (30secs Wingate Test). During the training sessions, the 30:4 group performed twice as much work as the 10:4 and the 10:2 groups. The 30:4 training protocol resulted in a 5.2% improvement in time trial performance, while the 10:4 demonstrated a 3.5% improvement and the 10:2 resulted in a 3.0% improvement. The 30:4 and 10:4 training interventions resulted in statistically significant improvements in maximal aerobic power (30:4= +9.3%; 10:4=+9.2%). Conversely, the 10:2 interventions resulted in a non-significant increase of +3.8%. Maximal anaerobic power increased the most for the 30:4 (12.1%) when compared to the 10:4 (6.5%) and the 10:2 (4.2%). Overall, none of the training interventions resulted in any significant alteration in body composition (body mass, lean body mass, fat mass, or body fat percentage). Based upon this data, it appears that both 10 and 30secs interval protocols have the potential to significantly alter anaerobic and aerobic performance capacity. However, it appears that 4-minute rest intervals between bouts increase the effectiveness of the interventions. Additionally, it appears that 30-second bouts produce the greatest alterations to both aerobic and anaerobic performance capacity.

Hazell, TJ, Macpherson, RE, Gravelle, BM and Lemon, PW. 10 or 30-second sprint interval training bouts enhance both aerobic and anaerobic performance. *Eur J Appl Physiol* 110: 153 – 160, 2010.

Changes in Leg Power Appear to Improve Mobility in Older Adults.

The ability to impact the mobility and physical functional capacity of older adults is important for the overall health and wellness as the population ages. One comprehensive method for assessing mobility, which includes standing balance, chair stand, and gait speed, can be assessed with the use of the Short Physical Performance Battery (SPPB). Gait speed (GS) alone has also been shown to be related to disability and mortality. The ability to modify these measures with various training interventions is of particular importance to the clinician. It is possible that maximal power generating capacity exerts a greater influence on SPPB and GS as compared to maximal strength training. The present study was designed to examine the effect that power exerts on both SPPB and GS. To accomplish this, a total of 116 mobility-limited older adults were recruited to undertake a 16-week randomized controlled trial of two modes of exercise. The first mode was the InVEST program, which involved a series of progressive resistance training exercise using a weighted vest designed to mirror functional tasks and emphasize speed of movement. The second program was based upon the National Institute on Aging guidelines which targets both upper and lower body strength training in a progressive fashion. The following measures were performed on each group including assessments of leg power, maximal leg strength, balance as measured by the Performance-Oriented Mobility Assessment (POMA), and the rate pressure product at the maximal stage of an exercise tolerance test. Outcome measurements included the SPPB and GS assessments. Interestingly after controlling for age, site, group, assignment, and baseline outcome values, leg power was determined to be the only performance attribute in which changes were significantly related to clinically meaningful differences in SPPB. Based upon this relationship, it is clear that leg power, independent upon of strength, is an important factor contributing to the mobility and functionality of older adults. Therefore, it may be warranted for clinicians to include power or velocity-based training in the rehabilitative programs utilized by older adults. ■

Bean, JF, Kiely, DK, Larose, S Goldstein, R, Frontera, WR, and Leveille, SG. Are changes in leg power responsible for clinically meaningful improvements in mobility in older adults? *J Am Geriatr Soc* 58: 2363 – 2368, 2010.

Kyle Brown, CSCS

Using Whole Body Integrated Multi-Planar Exercises For Baseline Conditioning: Experience the Future of Conditioning by Going Back to Our Roots

about the **AUTHOR**

Kyle Brown is a health and fitness expert whose portfolio includes everything from leading workshops for Fortune 500 companies and publishing nutrition articles in top-ranked fitness journals, to training celebrity clientele—from pro athletes to CEOs to multiplatinum recording artists. Kyle's unique approach to health and fitness emphasizes nutrition and supplementation as the foundation for optimal wellness. After playing water polo for Indiana University, as well as in London, Kyle became involved in bodybuilding and fitness for sport-specific training. Kyle is the creator and Chief Operating Officer for FIT 365—Complete Nutritional Shake (www.fit365.com).

Think back to one of the most legendary series of movies of all time—Rocky. More specifically, go back circa 1985 to Rocky IV, where Rocky Balboa comes out of retirement to avenge the loss of Apollo Creed by fighting the super-human Russian named Ivan Drago. On one side, Ivan Drago is shown training for the fight with scientists monitoring his strength and power output with high tech computers as he performs isolated machine-based exercises like the leg press and pec dec fly. On the other side, Rocky Balboa is shown isolated in the middle of the Soviet wilderness training only with the tools of everyday life. For example, he is shown pulling a wheelbarrow full of bricks, running through knee-high snow, chopping wood with an axe, and shoveling snow. Yet, when it came to the fight, all of Rocky's training skills transferred over to his sport of boxing as he chopped down the Russian to reclaim the Heavyweight Championship. This style of training, and its transfer of conditioning fundamentals into sports and everyday life, is one of the main principles behind whole body integration.

Whole body integration is a style of training where instead of isolating a particular muscle, or muscle group, you utilize your entire body either to move or stabilize. Most drills we perform in the gym have a tendency to focus on isolated lifting (i.e., moving up in a field of gravity like a squat or a standing shoulder press). While these are excellent drills (because we are on our feet and promoting consistent chain reaction mechanics that will carry over to sport), they are incomplete. We also need to consider the all-important "shifting" considerations so that maximum carry over is realized. We often forget to consider this very important aspect of training, perhaps because it is rarely seen (or even thought about) in the gym setting. "Shifting" training involves moving a load through a field of gravity, not simply against it. Think about carrying boxes during a home move; we are lifting (against a field of gravity) and shifting (moving the boxes through a field of gravity from point A to point B as we shift across the floor). We do not incorporate "shifting" drills (i.e., moving through a field of gravity) when we think of nervous system patterning, force production, and stress lines into the body that transfer into sport.

Moreover, triplanar movement training (training within all planes of motion: sagittal, frontal, and transverse or front/back, side to side, and rotational) has become a hot topic in progressive fitness training. This is similar to the complex movement patterns of a workingman like a farmer, a professional mover, or a lumberjack. What we call "working out," they call "chores" or "work." All of the exercises, or "chores," that these workers perform involve whole body integration within multiple planes of motion. For example, when moving a dresser up a set of stairs, a professional mover will lift with their legs and use their upper torso muscles to hold and stabilize the load (the dresser) while walking up a flight of stairs. Not only are they lifting, but they are twisting and bending as they move the resistance around tough corners. In a typical gym setting, this would be like doing a step-up while holding a heavy medicine ball in front of you and twisting at the top of the step.

Here is an example of a multiplanar exercise routine that involves moving a load through resistance:

Complete a circuit of all three movements with 40 seconds of work and 20 seconds of rest between movements. Repeat the circuit three times.

1. Medicine Ball Single-Leg Step-Up into a Twist
2. Medicine Ball Lateral Shuffle into a Squat Press
3. Three Push-Ups into a Forward/Back Bear Crawl

Exercise
Medicine Ball Single-Leg Step-Up into a Twist

Movement

- Begin by holding the medicine ball at shoulder height in front of you with one foot on top of the platform.
- Step up with the other foot and drive the trailing leg's knee up into the air.
- Once the trailing leg is up and the other leg is completely stabilized on the platform, twist the medicine ball away from the trailing leg.
- Return the medicine ball back to the center, step off the platform and repeat the motion using the other leg.

Exercise
Medicine Ball Lateral Shuffle into a Squat Press

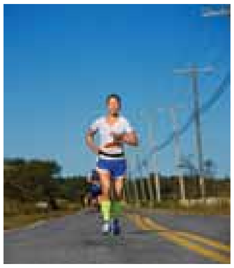
Movement

- Begin by holding the medicine ball at shoulder height in front of you in an athletic position with your hips slightly bent, your chest over your knees in a semi-squat position. Your weight balanced between the balls of your feet and the back of your hips.
- While maintaining an athletic position, shuffle to the right keeping your feet parallel with one another, your toes facing forward, and your weight on the balls of your feet.
- After completing three lateral shuffles, quickly stop and squat down holding the medicine ball at shoulder height. As you return back up from the squat, simultaneously press the medicine ball over your head.
- Rapidly shuffle laterally in the other direction, back to the starting position and complete another squat press.
- Repeat this drill for the allotted 40 seconds.

Exercise
Three Push-Ups into a Forward/Back Bear Crawl

Movement

- Begin by lining up on your hands and knees in a push-up position and perform three rapid push-ups. (Tip: you can add a load by wearing a weighted vest.)
- After you have completed the three fast push-ups, bring one arm forward and the opposite leg forward to propel yourself into a crawl. Make sure that you keep your hips down and your back flat.
- Rapidly crawl forward three steps until you are lined back up in a neutral push-up position.
- Perform another three rapid push-ups.
- Rapidly crawl backwards three steps until you are lined back up in the neutral push-up position at the exercise's starting point.
- Repeat this drill for the allotted 40 seconds. ■



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Eccentric Training for Distance Runners

Juan Gonzalez PhD, CSCS, HFI

Some running coaches advocate running hilly terrains to improve leg strength in a runner. However, which component of the hilly terrain gives you the most benefit, the climbing portion or the descending part of the hill? Some studies have been conducted to see if running economy and muscle damage occur through downhill running (1,2,3,4,5). Downhill running causes eccentric muscle activation. Essentially this means that the muscle lengthens under tension, such as downhill running.

It is the aim of this article to illustrate how to maximize your hill training to improve your eccentric leg strength. It will take various aspects of the hill descent and incorporate training routines that will focus specifically on the movement patterns and/or angles of the running descent.

Eccentric Hill Running

Find a hilly course with an incline/decline between 5 – 10%. To maximize the eccentric effect, find a climb/decline that is about half to one mile in length. After you have warmed up and stretched, begin by climbing the distance as part of your last warm up. The workout will be to run down the course in a controlled and relaxed fashion until you reach the bottom. Make sure that the slope of the hill does not bring out any more speed than you want—you want to be in control of the descent. Repeat the decline run four to six times as seen in Figures 1.0 and 2.0.

Eccentric Back Squats

Set up on a squat rack loaded with weight in the range of 75 – 80% of your 1 Repetition Maximum (1RM). Do three sets of six repetitions with a very slow, controlled descent. You can begin with ¼ squats and then progress to full squats as you develop more eccentric strength. Remember, the focus of this exercise is the decent part of the movement and the recovery is the squat up as seen in Figures 3.0 and 3.1.

Eccentric Isolated Reverse Leg Press

Set up on a reverse leg press loaded with a comfortable weight to move with one leg. Do three sets of six repetitions with a slow, controlled descent with one leg at a time. The key to this exercise is to line up the foot, knee and hip. The correct angles of decent are illustrated in Figures 4.0, 4.1 and 4.2.

Isolated Leg Balance

Begin with a wobble board with a wide enough base to begin doing isolated balance work on each leg. The goal is to mimic the angle typically seen while running down the hill. Begin going down as slow as possible while balancing on the wobble board. Extend your arms out for better balance as needed. As you progress, increase the level of difficulty by using a Bosu Ball with the dome facing down. Do three to four sets of six repetitions on each leg, as illustrated in Figures 5.0 and 5.1.

Eccentric Two-Leg Reverse Leg Press

Set up on a reverse leg press loaded with weight ranging from 80 – 90% of your 1RM. Foot placement on the plate should be about shoulder-width apart with your toes slightly pointing outward. Do three sets of six repetitions with a very slow, controlled descent for each repetition, as illustrated in Figures 6.0 and 6.1.

Eccentric Hill Running

Use the same hilly course with an incline/decline between 5 – 10% and run down the course in a controlled, relaxed fashion for about 800 meters. But this time, run down the decline about 3% faster than before, as illustrated in Figure 7.0.

Traditionally, athletes have used hill running to improve eccentric leg strength. The emphasis has typically been on the climbing aspect of the hilly terrain. This article has demonstrated specific training exercises that will maximize the eccentric strength in a runner's legs by focusing on the eccentric training exercises that mimic the movement patterns in downhill running and slowing down these movement patterns. ■

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Figure 1.0 Controlled descent


Figure 2.0 Controlled Desent


Figure 3.0 Back Squat


Figure 3.1 Back Squat


Figure 4.0 Isolated Leg Press


Figure 4.1 Isolated Leg Press Slow Desent


Figure 4.2 Side Isolated Leg Press


Figure 5.0 Isolated Leg Balance Progression One


Figure 5.1 Isolated Leg Balance Progression Two


Figure 6.0 Two-Leg Press


Figure 6.1 Two-Leg Press Slow Descent


Figure 7.0 Improved Descent

about the AUTHOR

Chat Williams is the Supervisor for the Norman Regional Health Club. He currently sits on the National Strength and Conditioning Association (NSCA) Board of Directors and is the past NSCA State Director Committee Chair, Midwest Regional Coordinator and State Director of Oklahoma (2004 State Director of the Year). He also served on the NSCA Personal Trainer SIG Executive Council. He is the author of multiple training DVDs and co-author of 3-D Legs. His company, Oklahoma Strength and Conditioning Productions, offers personal training services, sports performance for youth, metabolic testing, and educational conferences and seminars for strength and conditioning professionals.

Flexibility Training: Incorporating All Components of Fitness

Chat Williams, MS, CSCS,*D, NSCA-CPT,*D

Introduction

When participating in fitness programs individuals will often set goals focusing on improving muscular strength, muscular endurance, cardiovascular endurance, and body composition. Many times flexibility is often overlooked due to lack of interest or not taking the time to incorporate it into a fitness program. Individuals should consider including flexibility into their training regimen to complete a thorough, well-rounded program.

Flexibility Defined

Performing activities of daily living, recreational activities, and participating in sport-specific or athletic movements all require a degree of flexibility. Maintaining optimal flexibility can increase performance. Flexibility can be defined as the movement or degree of movement that takes place at a specific joint, which is also referred to as the range of motion (ROM). Age, gender, activity level, and the configuration of muscle-tendon structure can all play a role in the degree of ROM at a joint (2).

Types of Flexibility Training

The four key types of stretching include the following: static, dynamic, ballistic, and proprioceptive neuromuscular facilitation (PNF). They are defined as:

- Static: The ability to maintain a stretch while elongating a muscle at a specific joint for an amount of time with mild discomfort (4). Static stretching may be considered the safest and most used method of flexibility training.

- Dynamic Flexibility (warm-up): Incorporates bodily movements that are related to the activity or movement patterns needed for the specific event (2). Performing high-knees, walking lunges, and carioca are just a few examples of dynamic flexibility exercises.

- Ballistic: Can be defined as a bouncing movement that is rhythmic in nature, where the end position of the stretch is not held. Performing a seated hamstring stretch with a bouncing movement instead of holding the stretch at the toes would be an example of a ballistic stretch (2,4).

- Proprioceptive Neuromuscular Facilitation (PNF): Incorporates concentric and isometric movements that involve three muscle actions (hold-relax, contract-relax, and hold-relax with an agonist contraction). PNF usually requires a partner to perform the stretches, or in the case where a partner is not present, a strap or band may be used for many of the stretches (2,5).

Flexibility Training: Examining the Research

- Warm-Up: Performing a dynamic warm-up prior to an athletic event or workout increases blood flow to the muscles, therefore increasing the temperature of the muscles. When the temperature of the muscles increases there is a positive shift in the metabolic rate, which leads to an increase in oxygen uptake and allows oxygen to be more readily available to the muscles (4). Incorporating a dynamic warm-up with proper progressions prior to a workout or event may lead to an increase in performance (3).

- Decreased Injury Rates: Decreasing injuries during an activity or sport is a primary reason individuals include or add flexibility exercises to a training program. Although there are several recommendations stating flexibility training or stretching may lead to decreased injuries, the science and research is still lacking. It would be difficult to make a definitive statement that "adding static stretching to a program would lead to a decrease in injuries" (1,4).

That being said, individuals should still maintain a normal range of flexibility for optimal performance. Studies have shown that individuals who are hyper-flexible and inflexible may be at the highest risk for injury when participating in an athletic event (6).

- Improved Performance: Several studies have been performed evaluating flexibility programs and the effect they may have on performance. Studies have shown individuals should maintain an optimal level of flexibility to improve overall performance (6). In a study conducted observing sprint performance, five different groups were observed. The group that included sprint training, resistance training, and flexibility training performed the best. This validates the importance of incorporating multiple components into a fitness program. Interestingly, a study that tested the effects of stretching, submaximal running, and practice jumps on vertical jump height found that static stretching had a negative impact on vertical jump height when performed immediately before the jump. The researchers also concluded that a general dynamic warm-up would be the most beneficial to enhance performance (4).

- Stretching and Flexibility: There have been over 25 studies conducted since the early 1960s that have concluded that stretching is an effective way to increase muscle flexibility and increase the range of motion at specific joints. Individuals that adhere to a flexibility program can maintain flexibility improvements for several weeks (6).

Program Guidelines and Suggestions

The following flexibility training suggestions can be incorporated into a fitness program to develop a complete, well-rounded routine.

Dynamic Warm-Up

A dynamic warm-up can be implemented prior to a workout or event to increase core temperature of the muscles and prepare the individual for increased intensity and increased muscular performance. The dynamic warm-up should be progressive in nature, consisting of 6 – 8 exercises, and taking about 5 – 10 minutes to complete. The following are just a few of the exercises that can be incorporated during a dynamic warm-up: high-knees (Figure 1), walking lunges, carioca, butt-kicks, Frankensteins (Figure 2), lateral shuffles, and skips.

Static Stretching

After completing the workout routine, the individual can perform either static stretching or PNF stretching as part of the cool-down. Static stretching should be performed after each bout of activity incorporating stretches involving all the major muscles and the joints the muscles cross. Each stretch should be performed 3 – 5 times and held for approximately 30 – 60 seconds. The intensity should be slow, controlled, and held to mild discomfort (Figures 3 and 4) (3). Static stretching is a simple way to incorporate flexibility training into a program because a partner is not needed and the exercises are simple.

PNF Stretching

PNF is another type of stretching that can be incorporated into a cool-down. PNF requires an experienced partner due to the complexity and possible risks associated with the stretches. If a partner is not present, then a strap or band may be used to perform PNF self-stretching (Figures 7 and 8). All three types of PNF involve three phases, which include a 10-second pre-stretch prior to performing the other phases of the specific stretches. The hold-relax phase begins with a passive pre-stretch to mild discomfort. While the partner applies force, the individual resists the movement with an isometric muscle contraction. The contract-relax phase begins with a passive pre-stretch to mild discomfort. The individual creates a concentric muscle action to complete a full range of motion. The hold-relax with agonist contraction phase adds a passive stretch and is the most beneficial due to both reciprocal and autogenic inhibition being utilized (2). There are six common stretches that target major areas of the body which includes hamstrings and hip extensors (Figure 5 and 7), calf and ankle (Figures 6 and 8), chest, groin, quadriceps and hip flexors, and shoulders.

Conclusion

Following these few simple guidelines and suggestions can be the key to developing a complete fitness program. Incorporating a dynamic warm-up prior to exercise and static or PNF stretching after exercise are just a few ways you can enhance your overall fitness performance. The program design example (Table 1) and the exercises pictured are just a few examples of many to get you started. ■

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Figure 1. Dynamic Warm-Up: High Knees

Figure 2. Dynamic Warm-Up: Frankensteins

Figure 3. Static Stretch: Hurdler Stretch – Hamstring

Figure 4. Static Stretch: Shoulder

Figure 5. PNF Stretch: Partner/Hamstring

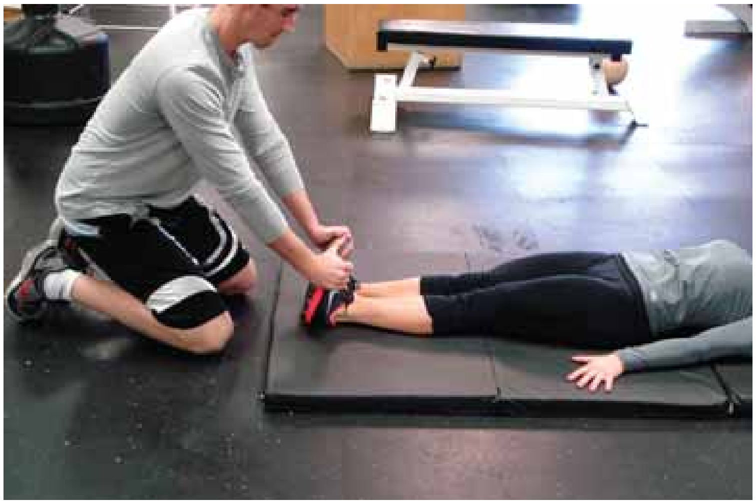

Figure 6. PNF Stretch: Partner/Calf

Figure 7. PNF Self Stretch: Strap/Hamstring

Figure 8. PNF Self Stretch: Strap/Calf

Table 1. Suggested Program Design to Incorporate Stretching

Program Design	Dynamic	Static	PNF
Program Orientation	Prior to Workout	Post Workout: During Cool-Down	Post Workout: During Cool-Down
Examples of Exercises	High-Knees Walking Lunges Frankensteins	Seated Hurdler Stretch Shoulder Stretch	Partner Hamstring Stretch Partner Calf Stretch Strap Hamstring Stretch
*Frequency	Prior to every workout	*3 – 5 times a week, post workouts	*3 – 5 times a week, post workouts partner present
Duration	5 – 10mins	5 – 10mins 30 – 60secs per stretch	5 – 10mins 30 – 60secs per stretch

Guidelines for Stretches

- Place the individual in a relaxed position
- Stretch should be moved to the point of mild discomfort
- Stretches should be held for 30secs
- Stretches should be performed on both sides of the body equally

Stretching Precautions

- Decrease the intensity of the stretch if individual experiences any pain throughout the range of motion
- Use caution when stretching a joint that may be hypermobile
- Avoid combination movements that involve the spine (extension and lateral flexion)
- Stabilizing muscles should be active to protect other joints and prevent unwanted movements

**Select either static or PNF depending on fitness level of the individual and the availability of an experienced partner or strap.*

Debra Wein, MS, RD, LDN, CSSD, NSCA-CPT,*D and Caitlin O. Riley

Protein Requirements for Athletes

A well-designed diet for an athlete is a combination of proper energy intake, proper timing, along with proper training. An energy deficient diet during training may lead to loss of muscle mass and strength, increased susceptibility to illness, and increased prevalence of overreaching and/or overtraining (7). People who follow a general fitness program can generally meet their nutritional needs with a healthy, well-balanced diet. However, the caloric and protein needs of a highly trained athlete are different and will be discussed here.

Considerable debate ensues regarding the proper intake of protein for athletes. The current recommended level of protein intake (0.8 g/kg/day) is estimated to be sufficient to meet the needs of nearly all (97.5%) healthy men and women age 19 years and older (2). This amount of protein intake may be appropriate for non-exercising individuals, but it is "likely not sufficient to offset the oxidation of protein/amino acids during exercise (approximately 1 – 5% of the total energy cost of exercise)" (2). If an athlete does not ingest sufficient amounts of protein, he or she will maintain a negative nitrogen balance, which can increase protein catabolism and slow recovery (7). Nitrogen balance is quantified by calculating the total amount of dietary protein that enters the body and the total amount of the nitrogen that is excreted (9). Table 1 provides general guidelines for protein and caloric intake based on the level of activity.

It is important to remember that not all protein is the same. Proteins differ based on the source, the amino acid profile and the methods of isolating the protein (7). Great dietary sources of low-fat, high-quality protein are skinless chicken, fish, egg whites and skim milk while the highest quality supplemental sources are whey, colostrum, casein, milk proteins and egg protein (7). The Food and Agriculture Organization (FAO) established a method for determining the quality of a protein source by "utilizing the amino acid composition of a test protein relative to a reference amino acid pattern and then correcting for differences in protein digestibility," (4).

Two of the most widely used protein supplements are casein and whey, which can both be found in milk products. Research has demonstrated that "whey protein elicits a sharp, rapid increase of plasma amino acids following ingestion, while the consumption of casein induces a moderate, prolonged increase in plasma amino acids that was sustained over a 7-hour postprandial time period," (1). The International Society of Sports Nutrition (ISSN) recommends that athletes obtain protein through whole foods, and when supplements are ingested they should contain both casein and whey "due to their ability to increase muscle protein accretion," (2).

While casein and whey have been found to be beneficial, other research exists to support the benefits of leucine. Approximately one third of skeletal muscle protein is made up of the branched-chain amino acids (BCAA) leucine, isoleucine and valine (8). Research suggests that of these three, leucine plays the most significant role in stimulating protein synthesis (5). Therefore, supplementation of branched-chain amino acids may be beneficial to athletes.

Researchers at the Department of Human Biology at Maastricht University in the Netherlands, conducted a study to determine post-exercise muscle protein synthesis and whole body protein balance following the combined ingestion of carbohydrates with or without protein and/or free leucine (6). Eight male subjects were randomly assigned to three trials in which they consumed drinks containing carbohydrates, carbohydrates/protein, or carbohydrates/protein/leucine following 45mins of resistance exercise. Results of the study showed that whole body protein breakdown rates were lower, and whole body protein synthesis rates were higher in the carbohydrate/protein and carbohydrates/protein/leucine trials compared with the carbohydrate trial. The addition of leucine resulted in a lower protein oxidation rate compared with the carbohydrate/protein trial. The study concluded that co-ingestion of protein and leucine stimulates muscle

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Table 1. Caloric and Protein Intake Guidelines

Activity Level	Caloric intake	Protein intake
General activity	25 – 35 kcals/kg/day	0.8 – 1.0 g/kg/day
Strength training athletes	50 – 80 kcals/kg/day	1.4 – 1.8+ g/kg/day
Endurance athletes	150 – 200 kcals/kg/day	1.2 –1.4 g/kg/day

Source: The Position Statement from the Dietitians of Canada, the American Dietetic Association, and the American College of Sports Medicine, Canadian Journal of Dietetic Practice and Research in the Winter of 2000, 61(4):176-192 (3).

protein synthesis and optimizes whole body protein balance compared with the intake of carbohydrates only (6).

BCAA supplementation has been shown to be particularly beneficial during aerobic exercise because of an increase in the free tryptophan/BCAA ratio (5). During prolonged aerobic exercise, the amount of free tryptophan increases and therefore the amount of tryptophan entering the brain increases, resulting in fatigue (5). BCAAs are transported to the brain through the same carrier as tryptophan, so when BCAAs are present in the plasma, in significant amounts, they may decrease the amount of tryptophan reaching the brain, therefore decreasing feelings of fatigue (2). It has been suggested that the recommended daily allowance (RDA) for leucine alone should be 45 mg/kg/day for sedentary individuals, and even higher for active individuals (8). A deficiency in BCAA intake from whole foods can be supplemented by consuming whey protein (2).

In conclusion, major organizations recommend athletes consume more than the RDA for protein, approximately 1.4 – 2.0 g/kg of body weight/d (2,4). Every attempt to obtain protein from whole foods is ideal; however supplementation is a safe way of obtaining the needed amounts of protein when necessary. ■

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Maintaining Fitness in the New Year: Tips for Developing Better Training Habits

Each New Year many individuals attempt to dedicate themselves to improving their fitness. However, even with the best intentions, many fail to adopt optimal training habits. Many factors in everyday life affect one's ability to be consistent with exercise (Table 1). The purpose of this article is to outline steps that may help a novice (one who is either new to exercise or who has been inconsistent with their training in the past) increase their likelihood of successfully incorporating exercise into their daily routine by addressing those factors and becoming aware of the proper exercise recommendations.

Exercise Adherence and Minimum Exercise Recommendations

The Centers for Disease Control (CDC) recommend baseline fitness levels for children and adults (1). Adults (ages 18 and older) should, at a minimum, perform 2.5 hours of aerobic activity during the week and perform strength training exercises at least two days a week (1). Table 2 presents training recommendations from the CDC based on the intensity of the exercise (1).

Injury, or a lack of time, may interfere with an individual adhering to these minimum exercise guidelines. Some individuals will implement an exercise routine and initially train too long or performing activities that are too intense for their current physical condition. Injuries may also occur creating a gap in training. The time off from activity affects motivation and causes many individuals to fail to resume their exercise routine. Others, in an attempt to achieve their exercise goals, give up on their routine burdened by work and family obligations.

Steps for Developing Better Training Habits

By being aware of the common pitfalls and knowing the exercise recommendations an individual can take steps to develop optimal training habits.

The first step is to dedicate a specific time each day to devote to your exercise routine.

The second step is recognizing that short bouts of exercise are beneficial and will help ease an individual into a routine. The CDC suggests that even short bouts of moderate exercise, as short as 10 minutes, can be counted toward a minimum, weekly aerobic exercise goal of 2.5 hours (1).

Finding a training partner is the third step. While having a training partner is not absolutely essential, having support from a friend or family member will increase an individual's ability to consistently exercise.

The fourth step is to simply listen to your body. It is common to experience muscle soreness when initiating a new

Table 1. Factors That May Affect Training Schedule

- Work Schedule
- Family Responsibilities
- Lack of Training Experience
- Injury
- Lack of Support from Family or Friends
- Boredom
- Lack of Progress/Failure to Achieve Goals

Table 2. Summary of Exercise Recommendations from the Centers for Disease Control (1).

Age Group	Aerobic Exercise	Exercise Examples	Strength Training Exercise
Children	60 minutes or more daily (either moderate or vigorous-intensity)	Moderate: fast walking Vigorous: running	Include muscle strengthening exercises three days a week
Adults (18 and older)	Moderate Exercise: 2.5 hours a week Vigorous Exercise: 1.25 hours a week	Moderate: bicycling, swimming Vigorous: running, sports competition, intense aerobic courses/activities	Include all major muscle groups two or more days a week

exercise program. Muscle soreness is associated with a burning and/or fatiguing experience within one's muscles—this is different than pain. Muscle soreness will resolve in a few days while pain is the result of an injury. If an individual should incur an injury, they should promptly schedule an appointment with a medical provider. Addressing an injury early on with help to hasten recovery and return the individual to activity.

The final step is to work with a professional like a National Strength and Conditioning Association Certified Personal Trainer (NSCA-CPT) or a Certified Strength and Conditioning Specialist (CSCS) who are trained in exercise prescription and devoted to helping clients meet their fitness goals. ■

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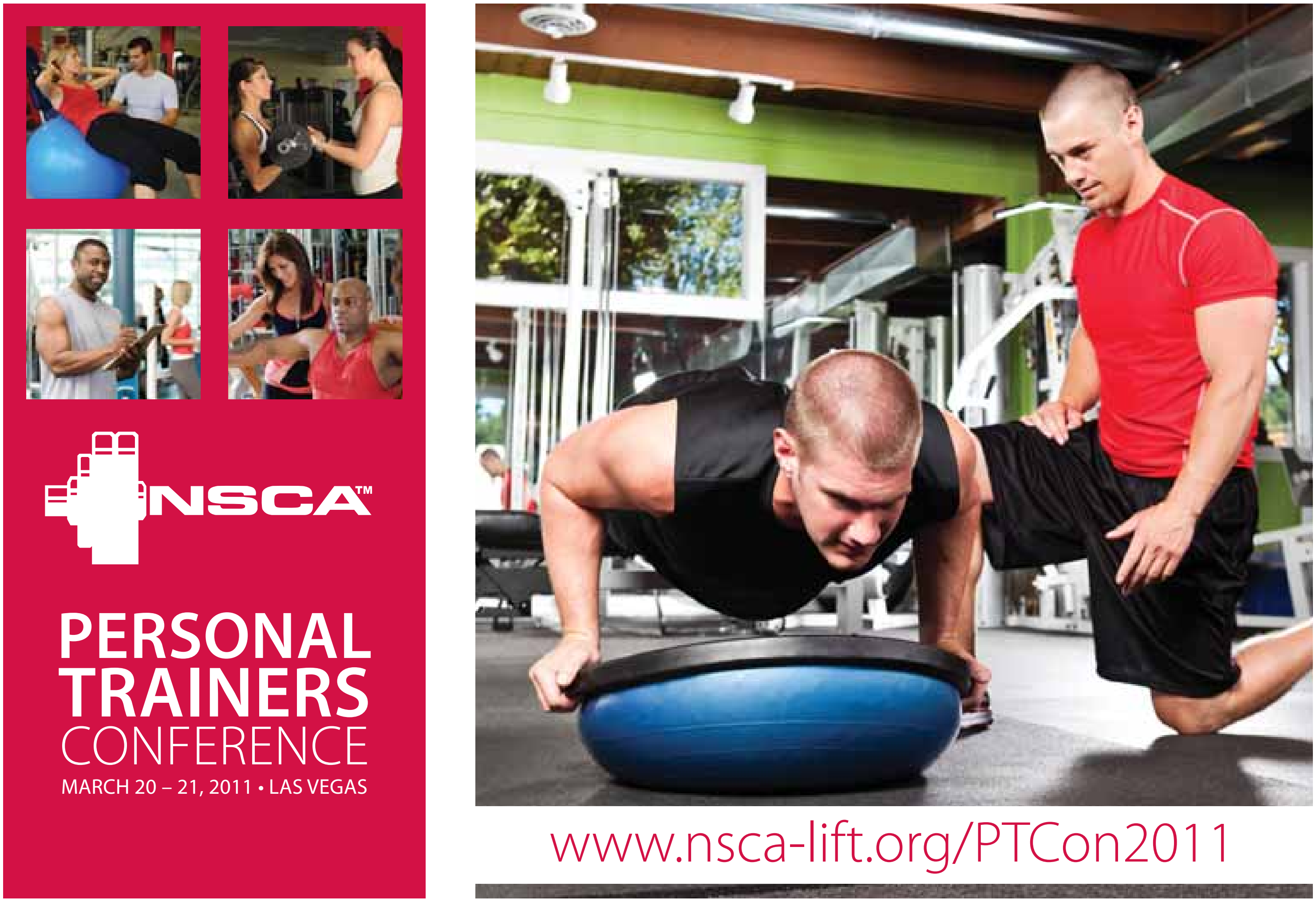
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