NSCA's
Performance Training Journal

Issue 9.2
March / Feb 10
www.nsca-lift.org

Off-Season Training

Features

Off-Season Training
*David Sandler, MS, CSCS,*D, FNSCA and Taylor Simon, CSCS*

Incorporating Pilates Into an Off-Season Training Program
*Ben Reuter, PhD, CSCS,*D, ATC*

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about this PUBLICATION

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NSCA's
Performance Training Journal

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G. Gregory Haff, PhD, CSCS, FNSCA

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Which is more important when attempting to develop muscular power generating capacity in weaker individual's strength or power training?

When working with seasoned athletes who have large strength bases, the use of complex training interventions are often warranted. However, when working with lesser-trained individuals the actual training structure needed should be less complex and possibly focused on more basic training outcomes. While it is commonly known that strength and power training are essential components of a resistance training plan, little is actually known about the magnitudes of improvements associated with each modality in lesser-trained individuals. Therefore, researchers at Edith Cowan University sought to explore the effects of 10 weeks of either heavy strength or ballistic power training on the jump and sprint performance in lesser-trained individuals. All subjects had their one repetition maximum (RM) back squat strength, 40m sprint time, and vertical jump height assessed prior to the initiation of the training interventions and after both weeks five and ten. Force to velocity relationships, jumping mechanics, muscle architecture, and neural drive were also assessed at these time points.

The 24 men tested at baseline were then randomly assigned to one of three treatment groups: control (n=8), power training (n=8), and strength training (n=8). When examining the baseline strength levels of the subjects they all could perform the squat but had a one repetition maximum (RM) < 1.5 times body mass (control = 1.37±0.13; power = 1.32±0.14; strength = 1.28±0.17) and were classified as being less trained or weaker. Across the 10 weeks of training, the strength group performed back squats with 75 – 90% of their 1-RM back squat, while the power group performed jump squats with 0 – 30% of their 1-RM back squat. Both the power and strength groups demonstrated improvements in jump (power = 17.6±4.5%; strength = 17.7±9.3%) and sprint (power = 3.6±2.3%; strength = 2.2±1.9%) performance following the 10 weeks of training. Only the strength group expressed a significant increase in overall muscular strength (power = 4.5±7.1%; strength = 31.2±11.3%). When carefully examining the two training groups, it was evident that each modality resulted in specific changes to the force to velocity relationship, jumping mechanics, muscle architecture, and neural activation patterns. Specifically, the strength training intervention resulted in a shift of the force to velocity relationship so that a greater amount of force and power were generated at a specified velocity, which was associated with an increase in maximal isometric strength. Conversely, the power training groups' adaptations were not associated with alterations in isometric strength even though they expressed an ability to produce greater force at a specified movement velocity. From a mechanical standpoint, the jump squats used in the power training group appeared to translate to improved jumping mechanics during the jump tests. However, an augmentation of the eccentric force during the jump test occurred as a result of the strength training intervention. This adaptation resulted in an improved acceleration through the eccentric phase which translated to a greater velocity of movement, power output, and jump displacement following 10 weeks of training. The strength training program also resulted in improvements in maximal muscle activation, while the ballistic power training resulted in a greater rate of electromyographic rise during the jump squat. Taken collectively, it appears that the training intervention has the ability to alter specific physiological processes that result in very specific performance adaptations. For example, the ballistic power training plan resulted in increases in the rate of force development, while the strength training plan resulted in increases in peak force generating capacity. As a whole, this data suggests that short-term ballistic or strength training results in a similar transfer of training effects selected performance measures as indicated by the similar changes in maximal power output, jump height, movement velocity, and sprint performance. However, the heavy strength training program resulted in alterations in the muscle thickness, which increased the muscle contractile apparatus as well as neural activation. These findings could then lead to the conclusion that lesser-trained individuals do not need to focus on power training because the long-term benefits of the strength training plan would provide the foundation for greater long term benefits for weaker athletes such as novice, youth, or endurance athletes. In fact, the researchers suggested that a distinct focus on power-based training would not be warranted until the athletes strength levels were 31.60 times their body mass. Additionally, they concluded that maximal strength was essential to the production of maximal power and the ability to enhance athletic performance.

Cormie, P., M.R. Mcguigan, and R.U. Newton. Adaptations in Athletic Performance Following Ballistic Power Vs Strength Training. *Med Sci Sports Exerc* (ahead of press).

Does 2 Weeks of Sprint Interval Training Improve Health-Related Outcomes in Sedentary Overweight Individuals?

Physical activity is widely accepted as a tool to improve the overall health and wellness of sedentary or obese individuals. However, most major organizations suggest that moderate-intensity exercise which accumulates to at least 30 minutes a day is the best approach. This basic philosophy has recently begun to be scrutinized and has now given rise to a paradigm shift in which higher intensity exercise that is performed for shorter durations is seen as advantageous. Recently, researchers from the University of Glasgow examined the effects of two weeks of very high-intensity interval training on metabolic and vascular disease risk factors in sedentary overweight/obese individuals. Ten men who had a body mass index of 31.0±3.7 kgm-2 participated in a 2-week training intervention which consisted of six sessions of 4 – 6 repeated 30-second Wingate anaerobic sprints with each sprint separated by 4.5 minutes of recovery exercise. Wingate sprints were performed against a resistance of 0.065kg per kg fat-free mass on an electronically braked cycle ergometer, while recovery exercise was performed on the same ergometer at a load of 30 watts. Metabolic, anthropometric, and fitness assessments were performed prior to and after the 2-week training intervention. After two weeks of training, the subjects maximal aerobic power (VO2max) went up by ~8.4%, while mean power output went up by ~3.6%. Additionally, significant improvements in insulin sensitivity index scores and resting fat oxidation rates were noted. Subjects also exhibited a significant ~2.3% decrease in waist circumference as well as a ~1.0% decrease in hip circumference when comparing pre and post-intervention testing results. Overall, the 2-week interval training program provided an effective training intervention for overweight/obese individuals as indicated by the performance, metabolic, and vascular health improvements. Of particular importance is that the total time allotted for training was substantially less than what is often recommended for traditional moderate intensity exercise, thus allowing for a more time-efficient method for inducing positive health adaptations.

Whyte, L.J., J.M. Gill, and A.J. Cathcart. Effect of 2 weeks of sprint interval training on health-related outcomes in sedentary overweight/obese men. *Metabolism* (ahead of press)

The Use of Cold Packs after Training as a Preventative Measure May Mute Training Effects.

The ability to adapt to a training stress is a careful balance between stimulation and recovery. Typically, when an athlete experiences a training stress, a cascade of physiological responses will occur during the timeframe after the cessation of the training session. During these timeframes anabolic hormones, such as growth hormones, will be released, while catabolic pro-inflammatory cytokines are released. These reactions appear to be a part of the natural remodeling process associated with training. In cases of traumatic injury, the application of cold packs is often recommended to reduce the pro-inflammatory response associated with the injury. Some individuals, in an attempt to prevent injury, use cold packs as a recovery modality in the belief that this application will enhance performance and potentially speed the rate of recovery. Recently, the effects of cold pack application on both anabolic hormone, pro-inflammatory, and anti-inflammatory cytokines were investigated in elite junior handball players after the performance of a sprint interval workout. The study consisted of two randomly assigned treatment orders in which the subject had cold packs or no cold packs applied to their lower extremities. During the session, the twelve elite junior handball players performed four 250m sprints at 80% of maximal sprinting capacity followed immediately by 15 minutes of cold pack application, 15 minutes without the cold pack, and then a second 15-minute cold pack application. The cold pack was applied to the subjects' hamstrings while the athletes passively rested. During the second session, the only difference was that no cold packs were applied during the 1-hour post-exercise timeframe. Blood samples were taken pre, immediately post, and one hour post-exercise and were analyzed for growth hormone (GH), insulin-like growth factor I (IGF-1), testosterone, cortisol, IGF-binding protein-1, interlukin-6 (IL-6), interlukin-1b (IL-1b), and IL-1 receptor antagonist (IL-1ra). The sprint interval work resulted in a significant increase in circulating pro-inflammatory cytokines (IL-6), GH, testosterone, and IGF-binding protein-1. The application of a cold pack resulted in a significant reduction in both pro-inflammatory (IL-1b) and anti-inflammatory (IL-1ra) cytokines as well as IGF-1 and IGF-binding protein-3. Collectively, the cold pack induced responses resulted in a reduction of anabolic hormone responses as well as a reduction in both pro and anti-inflammatory responses. These findings may suggest that in healthy scenarios, the application of a cold pack after exercise may potentially result in negative effects on athletic performance. ■

Nemet, D., Y. Meckel, S. Bar-Sela, F. Zaldivar, D.M. Cooper, and A. Eliakim. Effect of local cold-pack application on systemic anabolic and inflammatory response to sprint-interval training: a prospective comparative trial. *Eur J Appl Physiol* 107:411 – 417. 2009.

Kyle Brown, CSCS

Turning Weakness into Strengths in the Off-Season

Some athletes feel that the off-season is a time to let their bodies rest, fall completely off their diets, and spend this time partying the night away with little sleep or regard for their health and fitness. Typically, they use the pre-season as a time to rebound and acclimate to the demands of their sport. Yet, even as a weekend warrior, intramural or club athlete, having a year-round gameplan will keep you a cut above the competition and ready to hit the ground running in the pre-season. Moreover, focusing on your weaknesses in the off-season will bring a new and improved you to the field next season.

Off-season training is not only the best time to recover from your sport physically and mentally, but it is also the perfect time to train to counteract all of the muscle imbalances inherent in playing nearly any sport. The off-season varies depending on the particular sport, but in general terms, off-season refers to the weeks after the in-season and before the pre-season (1).

There is a fine line between resting too much and too little in the off-season. Ideally, an athlete should take the time off their sport to mentally rest as well as not put their primary focus on training the main muscles utilized for their sport. Instead, after a short period of rest (referred to as an unloading week), an athlete should focus on cross-training or working on their muscular weaknesses and imbalances to get refreshed without lowering their current fitness level. For example, some sports require one arm or leg to be utilized more or their opposing muscle groups are neglected (i.e., the quadriceps are working but the hamstrings are not utilized).

Some of the benefits of working on muscular imbalances during the off-season include: preventing chronic injuries, creating symmetry in strength and coordination, recovery of primary movers, strengthening of stabilizer muscles, and prevention of detraining or overtraining. During the off-season phase, a combination of resistance training and flexibility work will create stronger, less inhibited muscles. ■

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1. Bompa TO, Periodization training for sports. 1999. Champaign, IL: Human Kinetics

Figure 1. Sample of an off-season full-body resistance training routine

Movement	Reps	Sets	Weight
Plank	Max time	2	Bodyweight
Reverse Crunch	12 – 15		
Stability Ball Push-Up Into Tuck	12 – 15	2	Bodyweight
Walking Lunges Into Bicep Curl	12 – 15	2	50% of 1 rep max
Squat/Curl/Press on Bosu Ball	12 – 15	2	50% of 1 rep max
Squat Rows	12 – 15	2	50% of 1 rep max
Lateral Lunge	12 – 15	2	50% of 1 rep max

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).

Off-Season Training

David Sandler, MS, CSCS,*D, FNSCA and Taylor Simon, CSCS

about the AUTHOR

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The off-season is defined as, "a time of year when a particular activity, typically a sport, is not engaged in." However, it appears this definition is quite ambiguous when it comes to strength and conditioning. In terms of its direct application, the off-season would be the immediate period from which a season ends to when the new playing season begins its pre-season games. By definition, it would encompass the post-season, the off-season, and the pre-season preparation, although most coaches would separately define each period. Two important questions come to mind, "how long is the off-season," and "what constitutes an off-season." For those just beginning in the strength and conditioning profession, this can be a tricky set of issues to tackle. If you ask individual strength and conditioning coaches, you will get many answers and likely very few coaches agree on the same time frame. One thing is for certain; it is a period between sporting seasons and varies from sport to sport and within a particular sport depending on the level.

The Off-Season: Recovery or Preparation?

For many athletes and coaches, the off-season represents time to repair, regenerate and recuperate from a long season. Decades ago, players used the off-season to engage in other sports than the ones they played and some periodization models even suggested it might be beneficial to become active in dissimilar sport activity. Some coaches still use this methodology today even though it was shown in the early 1980s that competitive athletes need to continue to train all year round both for better performance and sport longevity (2). While the pre-season has traditionally been marked as the time of year to begin building strength and power, more recent practice has indicated that athletes need to get a jump on the competition by using the immediate post-season to recover (if necessary) and take that valuable off-season time to work on new strength, new skills, master technique, and develop a solid base for the upcoming season. Rather than call this time period the off-season, now it is often referred to as a "Transition Period" (1) where the coach can dictate the length of time spent working on weak areas for each individual athlete. Since many off-season periods can last several months, simply engaging in general physical activity or no activity at all, could cause a neurological shift in muscle recruitment patterns as well as both muscle size and strength decrements. Thus, the ensuing pre-season period would be used to "recover" all of the lost training time by forcing the body to relearn its specific motor patterns. On that same note, spending time overworking drills that may improve a weak area, may still not help with the athletes' overall sport performance and may detract from their actual sport capability. Older training models would suggest that the yo-yo effect is perfectly normal, or caused by training itself, however, more progressive coaches begin the off-season with an aggressive course of training to maximize performance for pre-season training.

Movement Screens and Sport Analysis

There is much information and speculation about athletes' needs but very few practical applications are evidence-based. Terminology such as sport analysis and movement screens have become commonplace for practitioners, yet many do not understand their true place in identifying athletes' weaknesses. While this article is not about either, we will mention that while a thorough needs analysis should be considered, it should be considered by the need of the sport and not necessarily by the athletes' weaknesses. The off-season, for many athletes, is earmarked by improving on weaknesses seen throughout the sporting season. Years of consistent training and practice, as well as demand by sport specificity, may in fact alter what is considered proper or normal movement patterns. The confusion appears to be in the cause-effect relationship of movement and performance. Is it the sport causing the movement or the athlete failing to move correctly? In other words, the "imperfect" movement patterns may not need to be corrected, as the sport itself dictates usage in many cases. Often coaches analyze weakness and develop a course of action to correct, thereby overcorrecting an issue. Although athletes may appear to be better at those specific drills after practicing them to improve weakness, they may have altered the required motor patterns to be

successful at their sport. This becomes increasingly more problematic when static or stationary drills are substituted for dynamic activity. Thus, as part of your needs analysis, you should consider movement execution, speed, power, and strength demands of the sport. The saying "Paralysis by Analysis" is echoed by the often over-corrective nature of an attempt to uncover weakness. The fact that an athlete may have had trouble getting open, catching a ball, or hitting a ball may be in the performance of those specific skills themselves and require more practice. This is especially true of athletes stepping up to the next level. We suggest a thorough examination of both movement and athlete, but caution hasty decisions in assessing weakness without relating movement to sport. To that end, true strength, power, and speed exercises still prevail as both are well evidenced methods and successful implemented practices. Without doubt, sport-specific skills such as throwing, kicking, and patterned movement should not be neglected, rather, they should be practiced even more. So when building your program, consider recovery for regular sport practice so that movement speed and skill are not compromised.

While there are many different schools of thoughts as to what and how to train, a common bond is now apparent: if you are not working, challenging yourself all year long, during every cycle of your periodized model, you will lose valuable training time, and likely be unprepared for your sport. This means that a plan is a necessity and although this last statement suggests that taking time off is not beneficial, preplanned rest or reduced activity phases are definitely a must to ensure that overtraining is prevented. For the newer or first-time strength coach, practice makes perfect, and expecting to have your periodized program work perfectly is unrealistic. Seasoned veterans of strength and conditioning will tell you they are still trying to perfect their training models.

The Plan

Before beginning an off-season training program you need to make sure your athletes have fully recovered from their season. Other then those athletes with specific injuries (such as knee, ankle, or other orthopedic issues), bumps, bruises, and general muscle soreness should subside within 10 – 14 days of rest. A general assessment and medical clearance may be required; otherwise your athlete should begin a general strength training program. Building an off-season strength base will ensure that when power, speed, and conditioning is required, your athletes will be prepared. However, just sticking to pure strength, short-changes the athletes' skill level, again reducing the effectiveness of your in-season training. It is for that reason, we suggest a program that is strength-heavy in terms of time allocation, but still does work on the other aspects of sport performance. Rather than use the traditional straight-line method of true concise and separate periods, athletes are finding much success with an approach that works on all components of sports while having a heavier influence in a particular variable, or area, during each phase of training. As periodization suggests, it is important to make adjustments, preventing plateauing and overtraining, and continually progressing the athlete toward their end goal of being prepared for the season. Thus, our 12-week model represents a slice of time that you will need to either increase or decrease depending on the length of your off-season. In our model, the immediate off-season is primarily strength focused for the first six weeks, gradually shifting toward power and conditioning as the new season approaches. Many athletes overwork strength, speed, and power training in the off-season foregoing important "reps" at their sport skills themselves. We suggest keeping workouts to three or four per week, and making sure regular skills are practiced on opposite days. Our athletes have seen the best gains using a four to eight-week consistent training period before making major adjustments. This means that you will need to plan accordingly as you stretch or shorten your off-season.

Success or Failure

Implementing a well thought-out plan is more difficult than developing the actual plan itself. Knowing how your athletes will respond is something we will never truly be able to predict. However, using a sound general program and tweaking it along the way improves your athletes' likelihood of success. You will get immediate feedback as to the effectiveness of your program as your athletes should continue to see improvement in at least one performance aspect, if not all, as regular training progresses. If you are not seeing improvement after a few weeks of training sessions, you should take a deeper look and make sure your athletes are working hard enough, but also that they are recovering properly. A successful off-season training program will dictate the success of the athlete not only as pre-season approaches, but as their careers continue. ■

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2. Wilmore J. and Costill, D. (1988) 3rd. ed. Training For Sport and Activity. Human Kinetics, Champaign, IL.

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Table 1. Off-Season Program

Macrocycle			Week	# of Workouts	Set Volume	Microcycle Overview
Weeks 1 – 4	**Strength**	**Strength**	**1**	**4**	**3 x 8**	**Upper Push/Lower/Upper Pull/Lower**
		Strength	2	4	3 x 8	Upper Push/Lower/Upper Pull/Lower
		Strength	3	4	4 x 8	Upper Push/Upper Pull/Lower Strength/ Lower Power
		Strength	4	4	5 x 6-8	Upper Push/Upper Pull/Lower Strength/ Lower Power
Weeks 5 – 8	**Strength / Power**	**Strength/Power**	**5**	**4**	**4 x 6**	**Upper Push-Pull Strength/Lower Strength/ Upper Push-Pull Power/Lower Power**
		Strength/Power	6	4	5 x 6	Upper Push-Pull Strength/Lower Strength/ Upper Push-Pull power/Lower Power
		Power/Strength	7	5	5 x 5	Upper Push Power/ Lower Power/Upper Pull Power/Lower Strength/Upper Push-Pull Strength
		Power/Strength	8	5	5 x 5	Upper Push Power/ Lower Power/Upper Pull Power/Lower Strength/Upper Push-Pull Strength
Weeks 9 – 12	**Explosive Power**	**Power**	**9**	**4**	**5 x 5**	**Plyometrics/Upper Push-Pull Strength/ Plyometrics/Lower Strength**
		Power	10	4	5 x 5	Plyometrics/Upper Push-Pull Strength/ Plyometrics/Lower Strength
		Power	11	5	5 x 3	Plyometrics/Full Body Strength/Plyometrics/ Full Body Strength/Plyometrics
		Power	12	3	5 x 3	Plyometrics/Plyometrics/Plyometrics

Workouts will always start with a Dynamic Warm-Up that includes movement preparation work and basic skills such as form and technique drills for sprinting. Additionally, dynamic stretches will be included as part of the movement preparation. Exercises will progress from slow rhythmic movements to ballistic movements as the warm-up progresses. You should spend about 20 minutes on your warm-up. Following the warm-up, you will begin explosive exercises first, followed by strength exercises and finishing with core and cool-down exercises at the end of the workout. On strength days, lift heavy going to momentary muscle failure or just short of that. On power workout days, use the same programs but reduce the weight by 20 – 30% and perform the movements more explosively without going to failure. The workouts above are general samples. You can add or subtract exercises depending on your time allocation per workout.

Lower Body
Squats
Split Squats
Lunges
Step-ups
Deadlifts
Leg Curls

Upper Pull
Pull-ups Wide Grip (or Lat Pull Down)
Chin-ups
T-bar rows
1-Arm DB Rows
DB pullovers
Biceps Curls

Upper Push
1-Arm Incline DB Press
Military Press/Push Press
1-Arm Shoulder Press
Pushups
Triceps Extension

Upper Push-Pull
Pull-ups Wide Grip (or Lat Pull Down)
Bench Press
Chin-ups
Military Press/Push Press
1-Arm DB Rows
Pushups

Lower Power
Hang cleans
Snatch
1-Arm DB Snatch
Squats
Step-Ups

Plyometrics
Squat Jumps
Split Squat Jumps
Box Jumps
Plyometric Pushups
Medicine Ball Throws (2 or 3 variations per workout)

General Core Exercises
Planks (Variations)
Hanging or Lying Leg Raises
Ab Crunch

about the AUTHOR

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Incorporating Pilates Into an Off-Season Training Program

Ben Reuter, PhD, CSCS,*D, ATC

Introduction

Pilates has been well-known in the dance world for over half a century. It has been popular in health clubs and fitness centers as a group class option for at least 10 years. According to an article in ACSM's Health & Fitness Journal, Pilates has been one of the top 10 fitness trends in the world since 2008 (4). However, Pilates hasn't reached the same popularity in the competitive athletic community. The purpose of this article is to briefly explain Pilates and then provide a sample workout that would be useful to incorporate as part of an off-season conditioning program.

Background

Pilates is a form of exercise. There are numerous methods or teaching styles for Pilates. At one end of the spectrum are traditionalists, who teach Pilates following the general practices and protocols provided by the inventor of Pilates, Joseph Pilates. At the other end of the spectrum, there are a number of methods that adapt Pilates to meet safety standards of the twenty-first century. At this end of the spectrum, there is a growing group of rehabilitation specialists—physical therapists and certified athletic trainers—who use Pilates as a tool to aid in their treatment of patients and athletes. A quick MedLine or SportDiscus database search for Pilates will show that much of the existing scientific literature on Pilates has focused on its use as a rehabilitation tool.

All Pilates methods rely on specific motions that are designed to help teach the participant to activate core muscles. There are Pilates exercises that can be done on a variety of Pilates equipment, called apparatus. The most commonly used apparatus is the Reformer. There are also a wide variety of Pilates exercises that can be done with no specialized equipment, commonly called mat Pilates. However, mat Pilates may use props to assist with the exercises. The props may be as simple as a folded towel, or may utilize equipment commonly seen in the weight room or fitness center, such as a foam roller. The exercises in the sample routine for this article are mat-based exercises, some of which will use a foam roller as a prop. For those readers who are already familiar with Pilates, you can see that the foam roller is substituting for the spine corrector in the exercise shown in figures 17 and 18.

The general goal of Pilates is to improve muscle strength, endurance and flexibility, with special emphasis on the core musculature (3). As discussed in Bernando's 2007 literature review on Pilates, published in the Journal of Bodywork and Movement Therapies, there is not a significant amount of scientific literature on the efficacy of Pilates exercise (2). This lack of research needs to be corrected if Pilates is to become a valuable part of athletic conditioning programs. Fortunately, the popularity of Pilates in the general fitness community appears to be stimulating more research studies. The most recent issue of the NSCA's Journal of Strength and Conditioning Research included a Pilates study with active middle-aged individuals as subjects. The reported conclusion was that Pilates classes could improve hip flexion, range of motion and trunk flexion endurance if implemented twice weekly (3).

At the most basic level, Pilates exercises can be used to teach individuals how to stabilize one part of the body while moving another (1). For example, maintaining a stable pelvis while moving the hips. At the more advanced level, many Pilates exercises will appear similar to common body weight or calisthenics type exercises. The purpose of this article is to provide you with the knowledge of a few easy to teach and learn Pilates exercises that are well suited for use by athletes. The exercises will concentrate on teaching disassociation, which was defined by Anderson and Spector as "isolating movement at the hip or shoulder girdle, independent of pelvis or spine movement," (1). This isolation of movement results in very precise motions that are often initially difficult for individuals who are highly skilled at sport-specific movements. The reason for this difficulty is because rarely, if ever, are the isolated movements required during a sporting event, or even during activities of daily living (ADL). However,

multiple isolated movements, when combined, result in common sports and ADL movements.

Rationale For the Exercises

The off-season is the perfect time to introduce new types and methods of training. Pilates is a good option because not only is it almost certainly different from the typical athlete's training program, it may also provide valuable benefits as the athlete progresses through the off-season and begins to prepare for the next season of competition. Typically, in-season training for athletes concentrates on sports-specific movements and movements directly related to improving sports performance. The off-season involves less sport-specific training and more general training. This is an optimal time to work on disassociation, or teaching the athlete to move the shoulder or hip while concentrating on maintaining a stable or controlled core or base.

The goal of this Pilates workout is to allow the athlete to become reacquainted with simpler and less complex movements than those that are commonly required during sports activities. The exercises in this program are designed to help improve motion and control of the shoulder and hip girdles. As mentioned earlier, the body of literature on the effectiveness of Pilates exercise is limited and much of what exists does not use young and active individuals as subjects. However, at the very least, if properly taught, these exercises are an excellent part of a general warm-up or cool-down program, and can help the athletes become more familiar with isolated movements of the shoulder and hip girdles.

Although the exercises described in this article are not as extensive as the twice weekly Pilates sessions described by Kloubec (3), it is still suggested that the program be performed at least twice a week. Since the main goal is to help the athlete become more familiar with isolated shoulder and hip girdle motions it may be possible for the program to be performed more than twice a week with no negative side effects. When instructing the athlete on correct execution of all exercises keep the following key points in mind:

- all motion should be slow and controlled, without using momentum to make the motion easier
- athletes should not hold their breath when performing the exercises
- perform a single set of 6 – 8 repetitions of each exercise
- encourage the athlete to think of the exercises as easy and fluid
- exercises that are unilateral (side plank and kneeling side kick series should be performed on both sides)

The Exercises

Side Plank

The side plank is an excellent exercise for teaching an athlete to move the shoulder girdle and the pelvis in distinct, separate and controlled movements. During the exercise there should be no side to side movement; all movements should be "straight up and down." The side plank has two distinct movement phases. Most athletes will need to start with a modified side plank. The starting position is shown in figure 1. The athlete is sidelying, with the elbow under the shoulder or slightly anterior, resting on the bottom hip with the bottom knee bent to 90 degrees. A progression of this movement would have the athlete starting while bearing weight on their hand (as shown in the full plank in figure 4) instead of the elbow. The initial movement phase is a shoulder girdle movement, which consists of depressing the shoulder girdle as shown in figure 2. The second movement phase of the side plank, as shown in figure 3, requires the athlete to move so that they are bearing weight on the elbow and the bottom knee. Completion of the movement requires the athlete to reverse the two phases. A full side plank, which is the most difficult to achieve is shown in figure 4.

Reverse Plank

The reverse plank exercise is an excellent exercise for lengthening the anterior shoulder musculature as well as activating the back extensors and hip extensors. This exercise is contraindicated for athletes with shoulder instability problems. The modified version of this exercise is called table top. The starting position for table top is shown in figure 5. The initial movement phase is thoracic extension as shown in figure 6a for table top, or in figure 6b for reverse plank. An excellent cue for the athlete is to ask them to "stick their chest out." The second movement phase for table top or reverse plank requires the athlete to activate their hip extensors and extend into a table top (figure 7) or a reverse plank (figure 8). It is not uncommon for an athlete to experience hamstring cramping during this the second phase of this exercise; a cue to help prevent this is to encourage the athlete to contract their gluteus maximus or "squeeze their butt." If an athlete has hypertrophied, or short anterior shoulder girdle muscles, there may be a tendency to allow the elbows to bend to make the exercise easier. For athletes who find it uncomfortable to bear weight with their wrists in an extended position, a small folded towel may be placed under the palm to reduce the amount of wrist extension.

Kneeling Side Kick Series

The kneeling side kick is an excellent exercise for lengthening the lateral trunk muscles as well as teaching the athlete to move their hip independent of their pelvis. The muscles required to perform many of the motions are some of the smaller muscles of the hip, including the six deep rotators, muscles that often are not isolated during most athletic movements. The set up for the exercise is shown in figure 9. The athlete should be encouraged to bear weight in a controlled manner on only the ball of the foot, rather than the entire foot. For athletes who find it uncomfortable to bear weight on their knee an exercise mat can be folded for extra padding or a small towel placed on top of the padded mat. The initial movement is lateral trunk flexion to the kneeling side, as shown in figure 10. It is possible to limit the lateral trunk flexion by placing a small prop, such as a yoga block underneath the weight bearing hand. Once the athlete has achieved the tripod position (foot, knee and hand support) there are a number of hip exercises that can be performed:

- hip abduction as shown in figure 11
- hip flexion/extension in hip abduction; figure 12 shows approximately the mid point of the motion
- knee flexion/extension in hip abduction; figure 13 shows the exercise in the knee flexion

The entire kneeling side kick series would consist of 6 – 8 repetitions each of lateral trunk flexion, hip abduction, hip flexion/extension in hip abductions and knee flexion/extension in hip abduction.

Seated Twist

The seated twist exercise is an excellent tool for improving hamstring length (by positioning the athlete in a lengthened hamstring position. It also helps to teach trunk movement independent of pelvis or hip movement. It is important to begin the exercise with the athlete sitting upright on their ischial tuberosities. If the hamstrings are short, as shown in figure 14, then a prop such as a folded towel or foam roller can be used to allow the athlete to achieve the upright positioning, as shown in figure 15. The starting position for the exercise is shown in figure 16a. The athlete is sitting upright with arms in approximately scaption. The motion is lateral rotation of the trunk to one side, as shown in figure 16b, independent of other motion. The way to eliminate other motion is to cue the athlete to notice the position of the legs. During the entire rotation movement the legs should not move. If an athlete is shifting his pelvis during the rotation to one side, then you will see the leg opposite of the direction of rotation lengthen. If this occurs it is likely that the athlete is trying to move farther than their torso rotation allows.

Foam Roller

Individuals familiar with Pilates will recognize that the foam roller, as used in figures 17 and 18, is being used as a spine corrector (one of the Pilates apparatus) is used for some exercises. The starting position as shown in figure 17 has the athlete lying on their back, with the sacrum supported by the foam roller and the lumbar spine in a flexed position. The heels are together with the hips externally rotated, the knees in line with the second toe and the ankles neutral or slightly dorsiflexed. In Pilates terminology this positioning of the hips, knees and ankles is called "zipped and wrapped." This terminology is used because the hip rotators are activated to "wrap" the thighs in external rotation. The term "zipped" is used to encourage the athlete to imagine the closing of the space between the medial thighs—like the closing of a zipper. Athletes with tight external hip rotators and/or tight hamstrings may have difficulty initially achieving a fully "zipped and wrapped" position. They may be unable to eliminate the space between the medial thighs, or have difficulty completely extending the knees. The motion from the starting "zipped and wrapped" position requires the athlete to flex the hips and knees, while keeping the heels together and the pelvis stabilized (which is aided by the positioning of the sacrum on the foam roller). The athlete then returns to a "zipped and wrapped" position by extending the hips and knees.

Conclusion

The Pilates exercises described in this article are only a small number of over 800 exercises. These exercises were chosen because they are easy to teach and learn, but they are also suitable for helping to develop the ability to move the shoulders or hips while concentrating on maintaining a stable or controlled core or base. These exercises can introduce the professional and athlete to Pilates. For those who decide to pursue further education in Pilates, I would encourage them to research the various teaching styles. The best option would be to seek out a style that has adapted the original Pilates exercise to ensure safety and current knowledge of human anatomy and physiology. There are a number of education programs run by physical therapists or other rehabilitation professionals, and these may offer the most effective and safe education. ■

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Pilates For Off-Season Sample Program

Goal

To allow the athlete to become reacquainted with simpler and less complex movements than those that are commonly required during sports activities. The exercises in this program are designed to help improve motion and control of the shoulder and hip girdles.

Sets and Reps

1 set of up to 6 – 8 repetitions

Frequency

At least twice a week; may be performed before/after activities as part of a generalized warm-up/cool-down

Exercises

Side Plank

Figure 1 • Side plank start

Figure 2 • Side plank shoulder girdle lift

Figure 3 • Side plank hip lift

Figure 4 • Full side plank

Reverse Plank

Figure 5 • Reverse plank start

Figure 6a • Preparation for table top w thoracic extension

Figure 6b • Preparation for reverse plank w thoracic extension

Figure 7 • Table top

Figure 8 • Reverse plank

Kneeling Side Kick Series

Figure 9 • Kneeling side kick start

Figure 10 • Kneeling side kick lateral trunk flexion

Figure 11 • Kneeling side kick in hip abduction

Figure 12 • Kneeling side kick hip flexion/extension in hip abduction

Figure 13 • Kneeling side kick knee flexion/extension in hip abduction

Seat Twist

Figure 14 • Seated twist long sit

Figure 15 • Seated twist long sit on foam roller

Figure 16a • Seated twist—Start

Figure 16b • Seated twist—Twist

Foam Roller

Figure 17 • Hip flexion w external rotation

Figure 18 • Frog

Figure 1. Side Plank Start

Figure 2. Side Plank Shoulder Girdle

Figure 3. Side Plank Hip Lift

Figure 4. Full Side Plank

Figure 5. Reverse Plank Start

Figure 6a. Preparation for Tabletop With Thoracic Extension

Figure 6b. Preparation for Reverse Plank With Thoracic Extension

Figure 7. Tabletop

Figure 8. Reverse Plank

Figure 9. Kneeling Side Kick Start

Figure 10. Kneeling Side Kick Lateral Trunk Flexion

Figure 11. Kneeling Side Kick Hip Abduction

Figure 12. Kneeling Side Kick Hip Flexion Extension in Hip Abduction

Figure 13. Kneeling Side Kick Knee Flexion Extension in Hip Abduction

Figure 14. Seated Twist Long Sit

Figure 15. Seated Twist Long Sit on Foam Roller

Figure 16a. Seated Twist Start

Figure 16b. Seated Twist Twist

Figure 17. Hip Flexion With External Rotation

Figure 18. Frog

Debra Wein, MS, RD, LDN, CSSD, NSCA-CPT,*D and Marcia Nelson

Nutrition For Recovery

Athletes are always seeking ways to enhance performance and delay fatigue. Muscle glycogen is the major fuel source during prolonged, moderate to high-intensity exercise, and there is a direct relationship between depleted muscle glycogen and fatigue. Therefore, muscle glycogen repletion is vital to recovery time and maintaining top performance for athletes at all levels (1).

Glycogen repletion is important to ensure an athlete's quick muscle recovery for subsequent practices, especially those who train, or must compete, multiple times in a single day (1). Timing, composition and the quantity of a post-exercise meal or snack is dependent upon the length and intensity of exercises, timing of the next exercise session, as well as an individual's needs (1).

Carbohydrates For Recovery—How Much?

The current recommendation for daily carbohydrates (CHO) consumption is 5 – 7g CHO/kg/day for the general athlete and 7 – 10g/kg/day for the endurance athlete (1). Consuming CHO immediately after exercise accelerates glycogen repletion (10) because there is increased blood flow to the muscles, which results in heightened sensitivity to insulin (9). Sufficient CHO ingestion over the next 24 hours is also important. Current recommendations are to consume 1 – 1.5g of CHO/kg of body weight within 30 minutes after exercise and then again at 2-hour intervals for the next six hours (1). See Table 1 for some ideas on what to consume within 30 minutes post-exercise.

Carbohydrates For Recovery—What Type?

The type of carbohydrate (CHO) an athlete consumes after exercise can affect how much and how quickly he or she resynthesizes glycogen. Foods and/or beverages containing glucose/ sucrose, and those having a high glycemic index are preferred. Glucose and sucrose are preferred over fructose (1), as fructose promotes a lower level of glycogen resynthesis as compared to glucose (3) and larger amounts of fructose may promote gastrointestinal distress due to its slower absorption rate(3). High glycemic index foods induce higher muscle glycogen levels as compared to low glycemic index foods (1).

Readily available foods, such as whole grain cereal and skim milk, have been found to be an effective post-exercise fuel (2). In fact, one study found that the carbohydrate to protein combination found in a bowl of whole grain cereal and skim milk had a similar effect on muscle glycogen repletion as did sports drinks (2). The combination was also found to positively affect protein synthesis. From this research, it seems that whole foods can be a good alternative to commercial sports drinks, if preferred by the athlete.

Endurance exercise

Endurance athletes may benefit from consuming protein along with carbohydrates after exercise as this combination has been shown to reduce markers of muscle damage and improve post-exercise recovery. This could also have a positive effect on subsequent performances (8).

Some studies have demonstrated a benefit of Branched Chain Amino Acids (BCAA) on muscle recovery (6). BCAA's appear to affect muscle protein metabolism during and after exercise and prevent muscle damage induced by exercise (6). The release of amino acids from muscles is decreased when BCAA's are ingested (6).

Resistance Exercise

The goal for athletes in resistance-type exercise is to increase muscle mass and strength. The nutrition intervention for this type of activity involves stimulating net muscle protein gains during recovery. PRO ingestion increases the rate of muscle protein synthesis and inhibits protein breakdown after training (10). One study found that during prolonged resistance training, post-exercise consumption of CHO and PRO, 1 – 3 hours after resistance training stimulated improvements in strength and body composition better than a placebo (3).

Essential amino acids in a dose of 40g have regularly shown to have an effect in promoting muscle protein synthesis and CHO may enhance this effect (3). The findings suggest ingesting 50 – 75g CHO with 20 – 75g PRO after heavy resistance training (3). Furthermore, adding 10g of creatine has shown to produce a significant increase in body mass as compared to just CHO and PRO (3). See Table 2 for possible CHO and PRO combinations.

about the AUTHOR

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Bottom Line

Nutrition post-exercise has been proven to promote recovery for athletes. Post-exercise nutrition has been shown to increase strength and muscle mass in athletes who participate in resistance-type exercises. Timing, composition and amount of post-exercise food is dependent upon the individual, timing of the next exercise session and the activity performed. ■

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Table 1. Examples of foods to consume within 30 minutes post-exercise

For a 50kg Female (50 – 75g CHO)	
1 serving Kashi Autumn Wheat Cereal	43g
1/2 cup skim milk	6g
1 cup sliced strawberries	13g
Total	62g CHO
1 oz. dried dates	21g
1/4 cup raisins	31g
Total	52g CHO
1 serving whole wheat pasta	43g
1/2 cup marinara sauce	12g
Total	55g CHO
For a 70kg Male (70 – 105g CHO)	
2 servings oatmeal	54g
1 cup skim milk	12g
1 cup sliced strawberries	13g
1 medium banana	27g
Total	106g CHO
2 oz dried dates	42g
1/4 cup raisins	31g
Total	73g CHO
2 servings whole wheat pasta	86g
1/2 cup marinara sauce	12g
Total	98g CHO

Table 2. Possible CHO and PRO combinations (50 – 75g CHO and 20 – 75g PRO) to consume post-exercise

1 serving whole wheat pasta	43g CHO	6g PRO
1/2 cup marinara sauce	12g CHO	2g PRO
1 serving ground turkey breast	0g CHO	28g PRO
Total	55g CHO	36g PRO
PB&J	70g CHO	19g PRO
2 eggs, cooked	1g CHO	13g PRO
2 slices whole wheat bread	42g CHO	10g PRO
1 slice cheddar cheese	0g CHO	7g PRO
1 banana	26g CHO	1g PRO
Total	69g CHO	31g PRO
4 oz. non-fat, plain Greek yogurt	5g CHO	15g PRO
2 oz. granola	30g CHO	8g PRO
1 banana	26g CHO	1g PRO
Total	61g CHO	24g PRO

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Strength and Power Training for the Female High School Basketball Team

Designing and implementing a periodized strength and conditioning program for the female high school student-athletes poses unique challenges. Sports medicine researchers are advancing our understanding of injury patterns for this population (1, 2, 3), developing injury prevention programs supported by research (4, 5), and fine-tuning rehabilitation strategies for the post-operative patient (6, 7). It has been my observation that female high school student-athletes have, in the past, participated in less than optimal strength training programs if participating in a training program at all. Compliance with strength training programs are further challenged by factors that compete for the athletes' time such as schoolwork, part-time or fulltime employment, social engagements, and family activities. Program success may also be influenced by poor dietary habits or the presence of an eating disorder (8).

This paper will describe a sample "strength/power phase" of an off-season strength and conditioning program for a female high school basketball team. The female basketball player is at risk for both overuse and traumatic lower extremity injuries (9). The incidence of knee related injuries highlights the importance of adequately preparing these athletes for sports through a periodized program.

The Strength/Power Phase

The goals for this final stage of the off-season program are to progress the athletes' strength and power in preparation for the start of the season (10). This is performed in part by adding power and explosive exercises and utilizing exercises that mimic specificity of sports (see tables 1a and 1b) (10).

Speed and agility drills (table 3) are also initiated in this phase. The exercises in this program mimic the functional movement patterns of the basketball athlete (12, 13).

Plyometric, Speed, and Agility Training Sessions

Two days a week, training drills should be performed to enhance functional components of basketball. These drills should mimic basketball-related activities. For example, the use of rim jumps (12), another name for two-foot jumps or hops, will be performed to replicate jumping for a rebound.

Each session should begin with a short 5-minute light jog followed by a dynamic warm-up routine (13). The power moves, agility, and speed drills will be performed first, followed by the plyometric drills.

Power, Agility, and Speed Training Program

Dynamic warm-up routine (13)

Down and off (12 reps each leg), pull-through (12 reps each leg), African dance (10 to 15 yards), drum major (1 set 10 – 15 yards).

"Power moves" (13)

Squat stance medicine ball throw, hurdle step medicine ball throw, depth jump, depth jump with lateral movement, and medicine ball lift throw from a lunge stance.

Agility and speed drills (13)

Mirror drill, medicine ball mini-tennis, half-moon tubing shuttle, wave drill.

Plyometric program (12): The plyometric program described here is adopted from work designed Chu (12). The athletes should have already been exposed to these "jumps" as part of the injury prevention program (4). The appropriate level of training during this off-season phase corresponds with 100 to 150 foot contacts per session performed at a low to moderate intensity (12).

Guards: rim jumps, lateral cone hops, forward cone hops, bounding for distance

Forwards and Centers: rim jumps, depth jump followed by vertical jump, depth jump with 180-degree turn, lateral cone hops, and low post drill

Conclusion

A sample "strength/power phase" is presented here for a high school female basketball team. A successful off-season training program must also include the "hypertrophy/endurance" and the "basic strength" phases. I highly recommend that a certified strength and conditioning specialist (CSCS) be consulted to design a comprehensive training program for the team. ■

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Table 1a. Strength / Power Phase

Week	Sets	Rest Period (Minutes)	Reps	Monday "Heavy" 100% assigned training load	Wednesday "Light" 80% assigned training load	Friday "Medium" 90% assigned training load	Tuesdays and Thursdays
1	3	5	5	87% 1RM	70% 1RM and 2 mi run	80% 1RM	Plyometric drills and speed/agility circuit
2	3	5	4	89% 1RM	72% 1RM and 2 mi run	80% 1RM	Plyometric drills and speed/agility circuit
3	4	5	4	90% 1RM	70% 1RM and 2.5 mi run	85% 1RM	Plyometric drills and speed/agility circuit
4	4	5	3	92% 1RM	75% 1RM and 2.5 mi run	85% 1RM	Plyometric drills and speed/agility circuit
5	5	5	3	92% 1RM	75% 1RM and 2.75 mi run	87% 1RM	Plyometric drills and speed/agility circuit
6	5	5	3	95% 1RM	75% 1RM and 3 mi run	87% 1RM	Plyometric drills and speed/agility circuit

Table 1b. Strength / Power Exercises • Weeks 1 – 6 • Monday, Wednesday, Friday

General program for all athletes. Core exercises performed prior to assistance exercises (11)

Core	Assistance
Power clean	Crunches
Push jerk	Bicep curls
BAck squat	Triceps extensions
Bench press	Seated Rows
Lunges	

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Accomplish the, As Yet, Unaccomplished

"I'm going for a Personal Record in the bench today. I just don't know if I can do it – it seems like so much weight."

"6'2"! Are you kidding me? I've never cleared that height in a competition."

"Curses. I drew Frank in the first round. I've yet to beat him in the 5 times we've faced each other. He must have my number. I'm not 0-5 against anyone else."

Facing a potential Personal Record (PR), or going against an opponent you have yet to defeat. Have you experienced a similar situation? How did you respond? Such scenarios (or similar ones) present tough physical and mental challenges. You are asking yourself to accomplish something you have never done before and, on top of it, you are trying to find the confidence in your ability to do so.

When faced with surpassing a PR, some athletes are able to perform up to their abilities whereas others are not able to do so and are, thus, unable to accomplish the unaccomplished. There is a huge mental component to breaking through performance barriers. Think about the 4-minute mile. It was once seen as one of those mythical barriers. For years, athletes had been approaching 4:00 but could not break through that wall. Yet, within one year of Roger Bannister running sub-4:00, multiple other runners broke through that time barrier as well. It was not that the athletes were physically unable to run a mile under four minutes, it was that a mental barrier had been created, setting this up as a near impossible task. Once the mental barrier was removed from the mind, the body was "freed" to accomplish the physical task.

You want to be one of those athletes that reached the "impossible goal," right? Of course you do. Let us review some strategies that you can implement to help you surpass these barriers (physical and mental) and have a successful performance. [Note: you don't need to implement all of the strategies. Rather, practice and implement the one or two strategies that make most sense to you.]

Focus on the process. In such challenging situations as described previously, what tends to be your predominant thought? What is your focus? For many, the focus is on the challenge or the outcome of performance, i.e., the victory, PR, pinning an opponent. It is important to get your thoughts away from the outcome and, instead, place your mental energy on what you need to do to accomplish the task. Focus on what you control—your performance—not the end result. For example, when approaching the bar, focus on the various elements of your pre-lift routine, critical aspects of your technique or your breathing (as opposed to the weight on the bar).

Do it then do it. No, it is not a typo. You read it right—do it, then do it. That is, first mentally perform—see, feel, mentally experience successfully executing the lift, clearing the height or beating an opponent. Then, physically perform the skill just as you did in your imagery. In using imagery, you are mentally accomplishing the challenge which can help you prepare for the task and enhance your confidence in your ability to physically accomplish the task.

Give yourself reasons to believe. When you stop to think about it, it makes sense that you might have doubts as you are asking yourself to accomplish a task you have yet to accomplish. Don't accept the doubts, instead, battle them. That is, convince yourself with "the facts" as to why you should be and why you will be successful. Identify the reasons you will be successful and use these to battle the lingering doubts. These reasons can come from things you have done in training, past competitions, comments from coaches or teammates, or your work ethic.

Downplay it. There is a tendency to make a task or obstacle a monumental challenge because it has yet to be accomplished and there may have been many failed attempts along the way. This can make the obstacle grow to mythical proportions. Knock it down, mentally, to what it really is. Instead of thinking about the weight on the bench as something you have failed at twice, remind your-

self that it is only two kilograms more that you lifted last week. Similarly, the opponent you are facing should not be viewed as someone "I just can't beat." Rather, the opponent is someone you match up well against and to perform well you need to attack their backhand, for example.

Try, try again. You could not complete the rep without a little help, you missed the height, you lost the match. How you react to this failure is going to, in part, influence future attempts at similar challenges. Are you telling yourself, "I'll never be able to do this?" Or, are you already analyzing what you need to do differently and what you need to work on to improve your performance? Learn the lessons from your failures and apply them to future endeavors when you try, try again. ■

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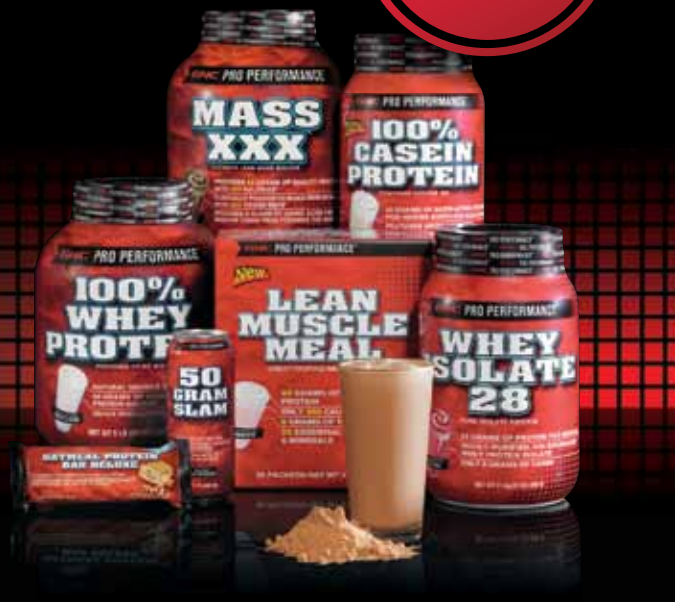

A QUICK GUIDE TO PROTEINS

	GRAMS PER SERVING	MORNING	BETWEEN-MEAL SNACK	PRE-WORKOUT	POST-WORKOUT	EVENING/ BEDTIME	ON-THE-GO
100% WHEY PROTEIN	20	◉		◉	◉		
MASS XXX™	50		◉		◉	◉	
100% CASEIN PROTEIN	25		◉			◉	
WHEY ISOLATE 28	28	◉		◉	◉		
LEAN MUSCLE MEAL	40		◉		◉		◉
50 GRAM SLAM™ DRINK	50	◉	◉		◉		◉
OATMEAL PROTEIN BAR	30	◉	◉				◉

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