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Hockey

Features

Hockey Movement Analysis and Needs Assessment
Michael Bridges, MS, CSCS

The Importance of Trunk Stability and Flexibility for Hockey Players
*Joel Raether, MAEd, CSCS,*D*

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NSCA's Performance Training Journal

about this PUBLICATION

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G. Gregory Haff, PhD, CSCS, FNSCA

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High-Intensity Interval Training Improves the Lactate Threshold in a Dose Dependant Fashion.

Success in endurance-based activities can be affected by many factors, such as the individual's maximal aerobic power (VO2max), economy of movement, and lactate threshold. When examining the scientific literature, the lactate threshold has consistently been noted as being extremely important. Because of its underlying importance to endurance performance considerable attention has been paid to finding methods which can efficiently elevate the lactate threshold.

Recently, researchers from Minnesota State University and the University of Wisconsin-Eau Claire examined the effects of integrating high-intensity interval training into the habitual training practices of 20 physically active individuals. All subjects habitually performed between 3 – 6 hours a week of aerobic training for a minimum of six months prior to participation in the present study. Subjects were randomly assigned to one of two treatment groups. Treatment group one performed one interval training session per week in addition to their regular training regime, while treatment group two performed two interval training sessions per week. All interval training was performed on a cycle ergometer at 110 – 120% of the subject's peak wattage in a graded exercise test.

For the first two weeks, subjects performed six 30's intervals at ~110% of peak workload. During weeks 3 – 4 the number of intervals was increased to seven and the intensity was elevated to ~115% of maximum wattage. Eight intervals were then performed at ~120% of maximum capacity for weeks 5 – 6. All interval bouts were performed at a one to seven work to rest ratio.

Post-training testing revealed that both interval training interventions elevated the lactate threshold. However, it appears that there is a dose response effect with two sessions per week resulting in a 3.9% greater increase in the % VO2max that the lactate threshold occurs. Additionally, the two day per week interval intervention resulted in significantly greater increases in the subject's work output at lactate threshold and overall peak work capacity.

Based upon this study it is clear that interval training can significantly elevate the lactate threshold and work capacity. Additionally, it appears that two days per week results in a superior training response. While the results of this study clearly indicate that interval training is a powerful training tool it is important to note that further research is warranted in order to determine how to optimally integrate these training methods into the overall training plans utilized by athletes.

Dalleck, L, Bushman, TT, Crain, RD, Gajda, MM, Koger, EM and Derksen, LA. Dose-Response Relationship Between Interval Training Frequency and Magnitude of Improvement in Lactate Threshold. *Int J Sports Med, 31(8): 567 – 571*.

What Happens to Aerobic Fitness and Body Composition During a 13-Month Military Deployment?

When on deployment, the physiological demands placed on the tactical operator are extensive. Prior to leaving for deployment it is common practice for these individuals to engage in extensive physical training regimes which are designed to prepare them for the multitude of combat and non-combat scenarios that arise. Once deployed, there is less ability to engage in a routine physical fitness regime. While the activities that are regularly engaged in are not structured exercise, they do engage the operator in substantial physical stress which may be adequate for maintaining fitness. However, very little research has been conducted to evaluate the impact of operational deployment on physical performance capacity.

Recently, Lester and colleagues examined the effects of a 13-month deployment in Iraq on the fitness and body composition of tactical operators. Seventy-three combat operators were recruited for the study and participated in several testing sessions prior to and after a 13-month deployment to Iraq. Body composition was evaluated with the use of dual X-ray absorptiometry, while maximal strength was measured with the use of a one-repetition maximum (1-RM) back squat and bench press. Additionally, aerobic endurance was determined with the use of a two-mile timed run. Operators also filled out exercise and injury questionnaires. After the 13-month deployment the combat operators demonstrated significant increases in body mass (+2.9%), body fat mass (+8.7%), body fat percent (+4.2%) and lean body mass (+3.0%). Both the 1-RM bench press test (+7.4%) and squat test (+8.1%) demonstrated significant increases after deployment. Similarly, significant increases in bench press throw (+8.7%) were noted. Conversely, aerobic endurance was significantly reduced (-12.6%) as well as estimated aerobic power (VO2max) (-12.3%). Exercise questionnaires revealed that while on deployment fewer soldiers participated in aerobic exercise or sports activities. While strength and power were maintained during deployment the reduction in aerobic performance coupled with the increase in body fat mass suggests that unit commanders must consider the development of specific deployment-based fitness interventions to maintain the overall combat readiness of the operator. Further research to determine the make-up and application of these interventions is warranted in order to better prepare the combat operator for the rigorous conditions associated with deployment.

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Strength Training: Does it Improve Endurance Performance?

Many endurance athletes and coaches are skeptical about the potential benefits of resistance training. Typically, this skepticism is centered on the fact that resistance and endurance training results in divergent adaptations. Because of this, endurance runners typically perform very little, if any, resistance training in their exercise program. Many times, if resistance training is performed by endurance athletes it is structured as a circuit. Recent evidence suggests that integrating resistance training into an endurance athlete's training plan can result in improvements in many factors associated with high-level performance. While the scientific literature has begun to show evidence of the ability of resistance training to enhance endurance performance, more inquiry needs to be made about different models of training and how they may optimize endurance performance.

Recently, researchers for the University of Jyväskylä examined the effects of integrating resistance training which focused on muscular strength, explosive strength, or strength endurance with endurance training. The training interventions were designed to be integrated in a sequential fashion and apply basic block-modeling periodization strategies. All groups started the study with a basic strength preparatory phase which lasted six weeks. This phase contained 2 – 3 sets of 10 – 15 repetitions performed between 50 – 70% of one-repetition maximum (1-RM) on exercises such as the squat/leg press, knee extension, knee flexion, lat pull-down/bench press, calf raise and countermovement vertical jumps.

After this initial block of training, each group was then given an eight-week treatment condition. The strength emphasis group performed three sets of 4 – 6 repetitions at 80 – 85% of 1-RM of the squat and leg press and the two sets of 12 – 15 at 50 – 60% of 1-RM calf exercise. The explosive strength group performed three sets of six repetitions of 30 – 40% 1-RM explosive squats and leg presses coupled with several lower body plyometric exercises. Finally, the circuit training group performed three sets of 40 – 50 seconds of squats, push-ups, lunges, step-ups, calf raises and back exercises. The last block of the training program lasted 14 weeks and had a reduced volume of strength training which was specific to each training intervention.

When examining the endurance training program there were no significant differences in running miles or time spent participating in endurance training between the treatment interventions. There was, however, a progressive increase in running miles and time spent performing endurance training across the three blocks of training. The maximal strength and explosive strength interventions resulted in the greatest increases in the velocity of movement at VO2max, while only the maximal strength intervention resulted in improved running economy, while only minor changes in this performance factor occurred in response to the explosive exercise intervention. Careful examination of the data demonstrates that circuit-based resistance training, when added to endurance training, does not optimize performance. Utilizing interventions that increase maximal strength and/or target power development appear more beneficial for the endurance athlete. Another salient point is that recent literature has demonstrated that maximal strength development is the foundation for power development and future research needs to consider the ordering of strength and power development and its effect on endurance performance when coupled with traditional aerobic training plans. ■

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Kettlebell Swings For Hockey Players

Ice hockey is a full-contact, fast-paced, physical sport that requires the combination of strength, power, explosiveness, flexibility and intense cardio. The kettlebell swing incorporates all of these facets wrapped up into one exercise and should be a foundational component of every ice hockey resistance training protocol.

While kettlebells have recently emerged onto the mainstream fitness scene, kettlebells are actually a century-old Russian exercise tool. The kettlebell swing is a foundational movement with variations including the 2-arm swing, the 1-arm swing, and more.

When playing ice hockey, strength, power, and explosiveness are required for acceleration, speed, and rapid changes in direction. Kettlebell swings develop the posterior chain muscles of the body including the glutes, hamstrings, and back and are phenomenal for core strength and stability. Maintaining a strong core while engaging in ballistic movements is critical for hockey players.

Kettlebell swings are unique in that they are a ballistic exercise where the athlete lifts, accelerates, and then releases the weight. As hockey players need to move at a rapid pace then quickly change directions on a dime, ballistic training mimics this action.

Kettlebell swings provide increased flexibility, which may reduce the risk of certain injuries for hockey players. It also allows hockey players to move with greater dexterity, agility and finesse.

Lastly, not only are hockey players moving at around 20 – 30 miles per hour, but the unique demands of the sport mean that strength endurance is just as crucial as explosive power. When performing high repetitions of kettlebell swings, an athlete's heart rate will rapidly soar as if they are sprinting down the ice with the puck toward an open goal.

How To Perform a Kettlebell Swing:

Stand up straight with your feet hip-width apart. Place the kettlebell between your feet slightly behind you. Sit back into a semi-squat position and reach back for the kettlebell while you sit back and bend your knees to get into the starting position. Keep your back flat and look straight ahead. Grip strongly onto the kettlebell and rapidly swing the kettlebell backwards between your legs as if you are football center hiking the football to the quarterback. Quickly reverse direction and thrust your hips forward squeezing your glutes as you accelerate the kettlebell straight out in front of you. Let the kettlebell swing back between your legs and repeat. Make sure that you thrust your hips and squeeze your glutes on every repetition to generate power. Also, your arms should be relaxed and you shouldn't use your shoulders to perform this exercise or feel it in your lower back. ■

Hockey Movement Analysis and Needs Assessment

Michael Bridges, MS, CSCS

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Michael Bridges is the head strength and conditioning coach at the University of Denver. He oversees all aspects of program design and implementation for each of Denver's 17 varsity sports, and works directly with hockey, men's basketball, men's lacrosse, and men's and women's golf. Bridges earned his undergraduate degree from UNC Chapel Hill in 1998, then served as an officer in the United States Marine Corps for nine years. After leaving the service he assisted with the performance development of men's basketball, tennis and golf at the University of Florida, where he also earned an MS in Human Performance. Bridges is a Certified Strength and Conditioning Specialist and Sport Performance Coach.

As it is with any sport, hockey programs require specific and focused training to provide optimal results and better performance. When developing a program at the higher levels of competition, less focus should be placed on skill development with an increased focus on injury prevention.

A good place to begin when approaching the task of creating a hockey program is to look at common injury trends in the sport such as sports hernias, groin injuries, AC joint injuries, labrum tears, meniscus tears, and a myriad of lumbar spine issues. The three main concerns related to common injuries on a specific hockey team are if the injuries are 1) contact or non-contact, 2) common to the athletes in the program, and 3) related to a common factor such as the previous training program.

A movement analysis of the sport and of the athletes is important to determine how body positions and functional requirements impact the kinetic chain. Recognizing dysfunction is highly dependent on perspective. Hockey players often have abnormal gait patterns that are compounded by restricted thoracic spine rotation, hip tightness, and a natural tendency to externally rotate their feet.

The likely cause of the altered gait pattern is from constant skating, mechanical compensations and restrictions that permit synergistic dominance, and turning off motor units within muscles that should operate as primary contributors to on-ice skills. By leaving them dormant, the athlete may still be successful, but will be limited and at an increased risk of injury. In order to decrease the risk of injuries and improve performance, it is important to recruit these motor units.

The combination of altered gait patterns, the movement analysis, and injury research provides the starting point of the needs assessment. What follows is an abbreviated list that encompasses the most essential requirements. If addressed with proper training and progression, attention to these areas should reduce the number of the non-contact injuries previously mentioned and enhance performance in the process.

Specific need: Thoracic spine rotation in spinal flexion

Adequate thoracic spine mobility may help alleviate lower back problems. If the thoracic spine is "locked up," the body will compensate through the lumbar spine. Although the lumbar spine does rotate and extend relative to the pelvis and thoracic spine, movement at the individual lumbar vertebrae should be minimal relative to its neighbor. The lumbar region needs stability, which can be enhanced by maximizing thoracic range of motion. It is trendy to train thoracic movement through a variety of twists, lifts, chops, and core rotational exercises. However, it is important to ensure that the hockey player can rotate within spinal flexion.

One exercise to progress players to specifically is a low cable chop from a variety of stances. Rather than standing upright, assume an aggressive athletic stance standing perpendicular to a cable machine with the pulley set at ankle to shin height. Keeping the head and chest up, perform the chop from ankle to ankle. Movement progressions include stepping forward, laterally, or at an angle with the inside or outside leg as the chops are performed.

Specific need: Hip internal and external rotation in hip flexion

Quickness and reaction in many sports depend partly on ankle inversion and eversion. In hockey, however, ankle inversion and eversion is limited by the rigidity of the skates. Setting the angle of the blade on the ice, therefore, becomes a function of hip rotation. Athletes could "muscle through" this restriction, but not efficiently and not without placing a high degree of torque on the knee. Hockey players should not simply focus on clearing internal and external hip rotation. Because the hockey stance is in a position of hip flexion, the implications of hip rotation in flexion must be considered. A flexed hip changes the mobility and flexibility requirements of the hip joint and surrounding musculature, respectively, when compared to upright posture. Furthermore, the hip must be trained to accept internal and external rotation under tension. This is just a verbose way of describing dynamic stability.

Use a rear foot elevated split squat for leg strength and take it a step further rotating the foot of the loaded (front) leg slightly in or out. Turning the toes out places the loaded hip in an externally rotated position during squat execution. Turning the toes in places the hip in an internally rotated position. This should be implemented into your training plan with caution—if the hip does not allow itself to open (external rotation) or close (internal rotation), the knee will torque. Make sure the knee stays aligned with the toes during the squat. If you feel resistance through the knee, you should lower the intensity of the exercise or reduce the load.

Once you are comfortable with this exercise and its variations, look to improve active internal or external rotation through the loading pattern. Use a variety of well-known lunge matrices as well as a few box step variations. Start on top of an 18-inch box, with both feet pointed towards twelve o'clock. Keeping the weight on the left foot, remove the right foot from the box and tap it on the floor facing three o'clock and immediately return it to the top of the box, again facing back to twelve o'clock. This motion forces the left hip to actively accept external rotation through the eccentric "step-down" phase and internal rotation through the concentric "step-up" phase. To achieve dynamic internal rotation of the left hip during the eccentric portion and external rotation through the concentric phase, simply point the right foot inward toward nine o'clock as it taps the floor.

Specific need: Scapular dynamic stability for shoulder mobility

The shoulder is a joint unlike any other. Without getting too technical, it is basically a ball being held against a plate by a web of muscles, tendons and ligaments. The posterior muscles that hold the ball (head of the humerus) to the plate (glenoid) also attach to the scapula. That means you cannot consider shoulder range of motion without looking at scapular mobility. The scapula should elevate, depress, protract, retract, wing, tip, and rotate upward and downward. Basically, it should be able to move in every way around the outside of the ribcage. To maximize range of motion for arm movements (such as slap shots), scapular movement should be linked to shoulder movement. In a recent study published in the American Journal of Sports Medicine, Miyashita, et al. examined the maximal external rotation of the shoulder. They state that the glenohumeral joint only accounted for 106˚ of the 144˚ of external rotation. The remainder of the range of motion was created by thoracic extension (9˚) and scapular tipping (23˚). Miyashita, et al. continued to state that, "when the scapulothoracic and/or thoracic extension movements did not function well in the kinetic chain, the mechanical demands on the glenohumeral joint increased," (1). In other words, ignore the contribution of the scapula to shoulder movement and you will place the shoulder at risk.

An effective approach to linking scapular to shoulder movement is to compound varieties of shrug movements with overhead and horizontal pulls and presses. For example, perform a stiff arm push-up to a push-up, a shrug to a muscle snatch, a press to an overhead shrug, dead hang shrugs to pull-ups, stiff arm rows to rows, and stiff arm shrugs to dips. Here are some examples:

- Stiff arm push-up to push-up: concentric protraction, eccentric retraction
- Stiff arm rows to rows: concentric retraction, eccentric protraction
- Stiff arm shrug to muscle snatch: concentric elevation, eccentric depression
- Barbell press to overhead shrug (usually from a slightly split stance to avoid a lordotic lumbar region): concentric elevation, eccentric depression (unlike the shrug to snatch variety, this version works to eliminate scapular tipping)
- Stiff arm shrug to dip: concentric depression, eccentric elevation
- Dead hang shrug to pull-up: concentric depression, eccentric elevation (unlike the shrug to dip, this version works to eliminate scapular tipping)

The intent of the varied vectored resistance with these scapular movements is to train the scapula to move in conjunction with the humerus with varied vectored resistance. If we can link these movements together we can, hopefully, achieve appropriate kinetic chain function, reducing the likelihood of movement compensations that ultimately manifest as one of a number of shoulder injuries.

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The Importance of Trunk Stability and Flexibility for Hockey Players

Joel Raether MAEd, CSCS,*D

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Hockey is a complex sport that requires a vast array of skills to be successful. Being that hockey is a high-velocity anaerobic sport that involves high acceleration and deceleration, proper training necessitates a multifaceted and thorough scope to achieve optimal performance levels and diminish the potential for injury (4). The influence of the trunk and its capacity to rotate, stabilize, and also aid in maintaining dynamic balance and force capabilities during play cannot be underestimated. Common hockey skills such as skating and shooting require use of the lower body and trunk, strengthening these areas can enhance performance and reduce injuries (8).

Injury Considerations

Some of the most common non-contact injuries in hockey are groin pulls, strains, and low back injuries (3,6). These areas all have significance as you look at their involvement in relation to the trunk of the athlete and their flexibility. Flexibility training is important for decreasing injuries and improving skill execution and should target the lumbar and trunk region including the hips, groin, quadriceps and hamstrings because increased flexibility in these regions will improve skating speed and efficiency of movement (5).

The most successful programs appear to emphasize trunk stabilization through exercises with a neutral spine while stressing flexibility of the hips (1). Likewise, if an athlete displays weakness of the abdominal muscles, there is probability for unrestricted anterior tilting of the pelvis, which may lead to hyperextension and compressive loading of the lumbar spine (7). The trunk and supporting structures are crucial for hockey because during play the hockey player is primarily in a flexed hip and anterior tilted pelvic position. As in hitting for baseball, sequentially incorporating different segments of the kinetic chain for training the trunk may yield better returns in shooting performance for hockey (2).

The muscles that act on the thoracic spine and shoulder girdles are also important for rotational movement of the trunk and shoulders respectively. The pectoralis major, latissimus dorsi, anterior deltoid, and triceps brachii all are essential in generating force in shooting, and the muscles of the rotator cuff and upper back are essential in decelerating the shoulder girdle in skills such as stick handling and shooting the puck.

The considerations for training the core musculature are three-fold: 1) establish flexibility in the hips so that you have the ability to move fully in all planes of motion effectively and efficiently, 2) ensure that the lumbopelvic hip (LPH) complex has the ability to stabilize all structures in and around the area so that you can accelerate, decelerate, and deliver high levels of force, and 3) establish flexibility in the thoracic spine allowing full rotation needed for play.

Conclusion

The game of hockey requires effective functioning of the core muscles to provide spinal stability and trunk mobility. Training programs for hockey need to take into account the importance of the connection through the kinetic chain in producing efficient movements. Hockey requires a complicated blend of stability and mobility; therefore, establishing a progressive core muscular training program that follows a continuum of exercises that require both stability and flexibility, with eventual progression to high force rotational movements, will elicit optimal results.

Drills for hip flexibility may include standing leg swings, hip circumduction drills, as well as walking high hurdle drills focusing on multi-planar movements about the hip. The exercises that can help aid in the improvement, stability and flexibility of the LPH and T-Spine are outlined in Table 1 and are generally utilized as movement preparation exercises. Table 2 provides an example of an off-season microcycle for trunk training.

For the sake of the article, any additional training (i.e., traditional strength training) is not included, but would be the primary emphasis of a hockey training program and coincide with the example shown below. ■

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Table 1. Stability and Flexibility Drills

LPH	T-Spine
1. Pelvic Tilts (supine & standing) 10 – 15 repetitions	1. Kneeling Foam Roll (reach, roll, lift) (figure 3) 5 reps
2. Wall Striders (Figure 1) 2 x 10 seconds	2. Seated Rotate & Flex (figure 4) 3 each side
3. Unilateral Hip Bridge (figure 2) 2 x 10 seconds	3. Kneeling Reach Backs (figure 5 & 6) 5 each side

Table 2. Sample of a Microcycle Trunk Training Routine for Hockey

Exercises: 2 x week	Sets / Reps
MB Crunch	2 x 20
Bird Dogs	2 x 10 each
Kneeling Cable Lift (Figure 7)	2 x 10
Bilateral Cable Rotation High (Figure 8)	2 x 10
MB Windmill Throw Down	2 x 10
Kneeling MB Side Throw	2 x 10 each

Figure 1. Wall Striders

Figure 2. Unilateral Hip Bridge

Figure 3. Kneeling Foam Roll

Figure 4. Seated Rotate and Flex

Figure 5. Kneeling Reach Backs – Start Position

Figure 6. Kneeling Reach Backs – Finish Position

Figure 7. Kneeling Cable Lift

Figure 8. Bilateral Cable Rotation High (rotate to both the left and right)

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

Does Caffeine Promote Dehydration?

Caffeine may be the most widely used stimulant in the world. It is found in a variety of plants, dietary sources and non-prescription medications. Caffeine is often referred to as a nutritional ergogenic aid, but it has no nutritional value. Caffeine is absorbed rapidly and is distributed throughout the body water within about an hour. It has a metabolic half-life of about three hours and is excreted in the urine as a methylxanthine derivative. It is a cardiac muscle stimulant, smooth muscle relaxant, and a central nervous system (CNS) stimulant. One mechanism behind the latter is an increase in the excitability of neurons in the CNS. Caffeine also acts as a diuretic, stimulates gastric acid secretions, and increases plasma glucose and free fatty acid concentrations (6).

Ingested caffeine is quickly absorbed from the stomach and peaks in the blood in 1 – 2 hours. Caffeine has the potential to affect all systems of the body, as it is absorbed by most tissue (7). Since caffeine easily crosses the blood brain barrier as well as cellular membranes of all tissues in the body, it is difficult to determine whether the skeletal or nervous system is affected most by caffeine (1).

Caffeine and Dehydration

A possible downside to caffeine use is its diuretic effect. A recent review of caffeine and hydration found that there is little scientific evidence that caffeine intake impairs overall fluid status. In fact, many studies that have examined caffeine supplementation and fluid balance have found that doses of caffeine that are within the range proven to be ergogenic do not alter sweat rates, urine losses, or indices of hydration status during exercise. "Scientific literature does not support caffeine-induced dieresis during exercise and several studies have failed to show any change in sweat rate, total water loss, or negative change in fluid balance that would negatively affect performance," (3).

One study conducted on caffeine and dehydration studied the effect of various combinations of beverages (including caffeinated beverages) on hydration status by tracking body weight, urine and blood assays. The study found no significant differences in the effect of various combinations of beverages on hydration status of healthy adult males. Advising people to disregard caffeinated beverages as part of the daily fluid intake is not substantiated by the results of this study (4).

The School of Sport and Exercise Sciences at Loughborough University, in the United Kingdom, conducted a similar study on the topic and concluded that, "Acute ingestion of caffeine in large doses (at least 250 – 300 mg, equivalent to the amount found in 2 – 3 cups of coffee or 5 – 8 cups of tea) results in a short-term stimulation of urine output in individuals who have been deprived of caffeine for a period of days or weeks. A profound tolerance to the diuretic and other effects of caffeine develops, however, and the actions are much diminished in individuals who regularly consume tea or coffee. Doses of caffeine equivalent to the amount normally found in standard servings of tea, coffee and carbonated soft drinks appear to have no diuretic action. The vast majority of published studies offer no support for the suggestion that consumption of caffeine-containing beverages as part of a normal lifestyle leads to fluid loss in excess of the volume ingested or is associated with poor hydration status. Therefore, there would appear to be no clear basis for refraining from caffeine containing drinks in situations where fluid balance might be compromised," (5).

Banned Limits of Caffeine Intake:

Caffeine is a "controlled or restricted substance" as defined by the International Olympic Committee (IOC) and "effective January 1, 2004, the World Anti-Doping Agency (WADA), in conjunction with the medical commission of the International Olympic Committee, removed caffeine from the list of stimulants prohibited for use by athletes," (8).

about the AUTHOR

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The acceptable limit in sports sanctioned by the National Collegiate Athletic Association (NCAA) in the US is 15ug/ml urine. These high urinary limits allow athletes to consume normal amounts of caffeine prior to competition. A large amount of caffeine can be ingested before reaching an unacceptable limit. For example, if a 70kg person rapidly drank about 9mg/kg of body weight one hour before exercise, exercised for 1 – 1.5 hours and then gave a urine sample, the urinary caffeine level would only begin to approach the limit. An illegal urinary caffeine level makes it probable that the athlete deliberately took supplementary caffeine tablets or suppositories in an attempt to improve performance (7).

The side effects of caffeine can range from anxiety and jitters, to the inability to focus, and gastrointestinal unrest. However, most studies providing these results have used pure caffeine, not caffeinated foods or beverages, during testing. Therefore, it is not proven that consuming equal amounts of caffeine through coffee, for example, will have the same end result (7).

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Table 1. Caffeine Content of Popular Foods, Drinks and OTC Medications • Sources: Manufacturer Websites

Product	Caffeine Content (in mg)
Starbucks Brewed Coffee (16 oz)	320 mg
Starbucks Vanilla Latte (16 oz)	150 mg
Tea—Black (8 oz)	20 mg
Diet Snapple, Lemon (16 oz)	42 mg
Diet Coke (12 oz can)	47 mg
Diet Pepsi (12 oz can)	36 mg
Regular Coca-Cola (12 oz can)	35 mg
Regular Pepsi (12 oz can)	38 mg
Red Bull (8 oz)	80 mg
Monster Energy (16 oz)	160 mg
Hershey's Dark Chocolate (1.45 oz)	31 mg
Chocolate Soy Milk (8 oz)	6 mg
Excedrin (2 tablets)	130 mg
Hot Chocolate (8 oz)	5 mg

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Stretching Exercises to Improve the Flexibility of the Inner Thigh

The adductors are a group of muscles that form the inner (or medial) thigh. The primary function of the adductors is to bring the thigh toward the body (i.e., adduction) (table 1). However, during functional movements the adductors eccentrically decelerate ("put on the brakes") and stabilize the thigh. Athletes who participate in sports like swimming, ice hockey, football, and soccer are at risk of sustaining adductor strains (1, 3).

Injury Mechanisms

When running or skating, the adductors are at risk for strain during motions where the inner thigh experiences a quick stretch. For example, when a hockey player is skating he will drive forward by powerfully contracting the lateral and posterior hip muscles. In response to the powerful hip abduction and hip external rotation muscle contractions, the adductors will serve as a "brake" to help control the movement. If the eccentric load experienced in the adductors are above what it can tolerate, a strain will occur. Repetitive adduction movements performed during the terminal portion of the breaststroke leg kick have been reported to cause strains in swimmers (4).

Poor flexibility, dysfunctional hip strength, or a previous history of an adductor muscle strain have been reported as potential risk factors for athletes who sustain a hip adductor muscle strain (2, 3). The purpose of this article is to present a few stretching exercises that will help to improve flexibility of the adductor muscle group. Each stretch should be held for 30 seconds. At risk athletes should perform 2 to 3 repetitions each side daily.

1. Sitting Groin (Adductor) Stretch (figure 1)

One should sit on the floor or on a mat with one's feet (soles) together and pulled in close to the body. Grasp the feet with both hands and gently push the knees toward the floor with the elbows.

2. Supine Groin (Adductor) Stretch

Lay supine (on one's back) with the soles of the feet together and the hips rotated outward (the knees should be falling toward the floor). Allow the knees to "fall" towards the floor, feeling a stretch in the inner thigh/groin.

3. Kneeling Side Lunge (figure 2)

Position one's self with one knee on the ground and the opposite leg outwardly rotated as far as possible. The stretch is felt as one leans toward the supporting foot. This stretch may also be performed standing. Start standing with the legs positioned shoulder width apart and the feet slightly rotated away from center. One should step/lunge laterally as far as possible to one side with the stretch felt in the opposite leg.

Conclusion

By performing these stretches the risk of injury to one's adductors may be lower. A certified strength and conditioning specialist could help with any further stretching issues or concerns. ■

Figure 1. Sitting Groin (Adductor) Stretch

Figure 2. Supine Groin (Adductor) Stretch

Table 1. Functional Anatomy of the Adductors

Muscle	Function
Adductor longus	Hip adduction
Adductor brevis	Hip adduction
Adductor magnus	Hip adduction
Gracilis	Hip adduction, hip flexion, hip internal rotation
Pectineus	Hip adduction, flexion, external rotation

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Apples to Apples

about the
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Suzie Tuffey-Riewald received her degrees in Sport Psychology/ Exercise Science from the University of North Carolina —Greensboro. She has worked for USA Swimming as the Sport Psychology and Sport Science Director, and most recently as the Associate Director of Coaching with the USOC where she worked with various sport national governing bodies (NGBs) to develop and enhance coaching education and training. Suzie currently works as a sport psychology consultant to several NGBs.

*"In practice, I ran a personal best.
I don't get why I can't run that fast in a meet."*

"In the practice match yesterday, I had no double faults and was hitting great forehands down the line. In my first tournament match today, I had seven double faults and seemed to hit every forehand down the line into the net."

"I easily make 8 out of 10 free throws at the end of practice, yet in games I'm shooting 40%. It doesn't make sense."

Do these statements sound familiar to you? Do you find that you sometimes perform at one level in practice yet are unable to perform at that same high level in a competition? Certainly, a multitude of factors can come into play to influence performance and account for a difference between practice and competitive performances, factors such as your opponent, the weather, expectations of yourself and others, the competitive arena, confidence, tactics, strategy, and anxiety, to name a few.

That being said, let's take a look at one such factor that can influence your performance and, if addressed, can help you perform closer to your potential in the competitive environment—the training environment.

As a competitive athlete, you train to compete. You work on a daily basis to enhance your athletic skills so you can perform at a higher level in competition, whether it is to achieve a personal performance goal or make a national team. In essence, you train with the goal of performing well in the competitive environment.

Now to the critical question—is the training environment purposefully structured to help you perform well in the competitive environment? With many athletes, this isn't the case. Instead, training is typically structured to help athletes perform well in the training. Yet, athletes expect to be able to perform in competition as they do in practice (as reflected in the quotes above). It is like comparing apples to oranges in that the practice environment and the competitive environment are different. That needs to change if competitive performance is to improve.

Let's take a closer look. For many athletes, the practice environment (which includes the external environment and the internal environment of thoughts, focus, motivation etc.) is characterized as a physical endeavor where the athlete puts in the miles, runs through drills and/ or does a lot of repetitions to refine a specific skill. In this practice environment, athletes may not think about their internal dialogue, how they react to mistakes, and their attitude during early morning practices or their confidence, the focus is on the hard work of physical training. Additionally, many athletes do not practice under the potentially adverse conditions that can present themselves in a competition such as having to deal with crowd noise, dealing with a malfunctioning piece of equipment, like a racquet string that breaks or a pole vault pole that does not get delivered on time, playing in the heat of the day, among other things.

Contrast the mental skills needed in the training environment with those mental skills—the thoughts and behaviors—athletes are expected to be able to demonstrate in competition or skills they need to perform well. Athletes want (and need) to be confident, athletes want to keep self-talk positive and focused on what they need to do to perform well, athletes want and expect to manage their emotions so they don't hurt performance (i.e., throwing one's racquet after a double fault). Athletes need to deal with expectations of self and others, and need to manage their reaction to the crowds or their opponent. The list could go on but I think you get the message in that oftentimes comparing practice and competitive environments is like comparing apples to oranges.

How do athletes work to make practice and competition more like comparing apples to apples? Well, assess what you as an athlete are asking yourself to do in competition and train those skills (many of which have been discussed in this Mind Games column). For example:

You want to be positive and focused on performance so during practice work on managing your self-talk and practice using the internal dialogue and cue words that will facilitate performance.

You want to manage your reaction to mistakes or frustration in competition so challenge yourself to do the same in practice. Work on appropriate means of managing your emotions.

You want to approach competition with confidence so purposefully build your confidence by recognizing daily successes, recalling great practice performances, etc.

To prepare for external distractions, use imagery in training to simulate the competitive environment. Depending on your sport, you can also prepare for the environment by bringing in "fans" to observe practice, piping in noise or creating pressure or challenging situations.

Additionally, embrace challenges when they present themselves in practice. When a shoelace breaks or your racquet string pops mid-point, rather than give up, play through the distraction. Use that as an opportunity to learn how to play through adversity.

The bottom line is, if you can structure your practice environment to look more like your competitive environment, chances are you will see your competitive performances improve. ■

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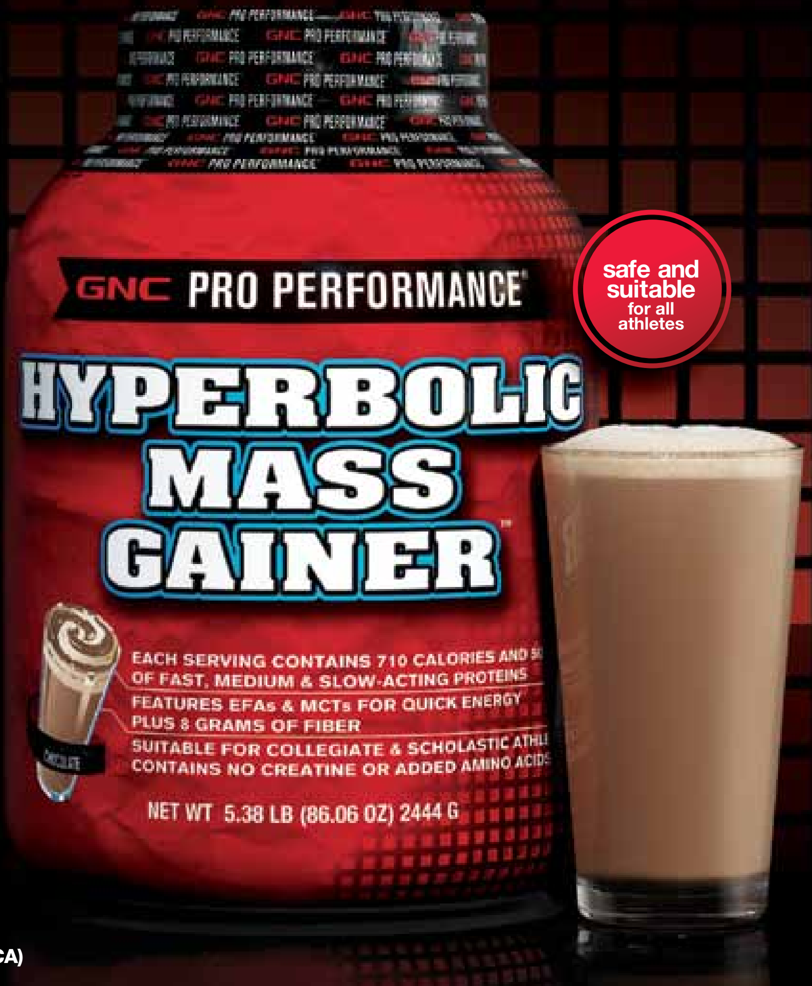

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