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It is often difficult to develop the bilateral symmetry necessary to perform athletically at high levels, especially when there is a propensity for one side of the body to dominate muscular strength, balance, neural patterns, and movement. Take for example swinging a golf club or baseball bat. For these movements, the athlete is in a fixed stance, rotating their body in the transverse plane to perform the necessary athletic movement. It has been shown that if one were to take an athlete who swings, throws, or kicks for their sport, and ask that athlete to perform any sort of movement screen or muscular balance analysis, it would be likely that a muscular imbalance or dominance would be seen in nearly every athlete tested (2,9). For a sport like basketball that requires movement in all planes of motion, the value of bilateral symmetry cannot be discounted or unvalued. In addition, studies have shown that bilateral symmetry of the lower limbs is correlated with better jumping performance (3,6,7). This suggests that inclusion of unilateral/asymmetrical movements would benefit basketball athletes in order to attain better symmetry.

While most training programs focus on bilateral movement and exercises, many of the movements found within these programs are designed to increase strength and power, but not necessarily improve the movement patterns seen within the specified sport or activity (4). This is not meant to discount bilateral movements or the necessity to develop strength and power in athletics. However, basketball is a game of rotation, acceleration, deceleration, jumping, finely-tuned motor skills of the hands, wrist, and upper body, as well as the ability to perform these movements while on one foot, moving horizontally, falling, twisting, or moving in multiple directions. This means movements in basketball are rarely exclusively bilateral in nature, which indicates that training should include unilateral/asymmetrical movements and exercises in order to better enable these athletes to perform basketball-specific movements optimally during competition. In addition, research shows a connection between unilateral power and performance in team-sport athletes, specifically multidirectional speed and horizontal power (5). This reinforces the value of including unilateral/asymmetrical exercise into a program for basketball athletes, as both of these traits are required for optimal performance in the sport.

One method for implementing unilateral/asymmetrical exercises is suspended bodyweight training with an added aspect of rotation and anti-rotation, or rotational bodyweight training. Although this training method uses suspended bodyweight to provide resistance, rotational bodyweight training works mechanically and physiologically much differently than suspension bodyweight training that lacks a rotational/anti-rotational aspect.

To understand how the inclusion of rotation differs from traditional suspension bodyweight training, it is important to understand how suspension bodyweight training works. All suspension bodyweight training exercises are based on several common factors including body angles, lever systems (i.e., height of the anchor and/or length of the straps or ropes), gravitational load or mass/weight of the athlete, and foot or hand positioning (1).
Traditional suspended bodyweight training exercises allow for linear and lateral movement. Because the anchor point is locked or limited in movement, the length of the straps remain constant, potentially limiting the range of motion (ROM) of the joints involved. Most suspension bodyweight trainers have locked or static anchor points. This means the anchor point either is individually locked/attached or attached at a central anchor/pivot point with little to no movement.

However, with rotational bodyweight training, the pulley system of the anchor can be unlocked, which creates rotational and anti-rotational demand, thus providing an additional stimulus to the body while performing suspended bodyweight exercises. A free moving pulley or anchor point creates an additional stabilization demand upon the individual, much like the difference between using a bar and dumbbells for a similar movement pattern.

Furthermore, because of its centralized moving anchor point, a rotational bodyweight trainer can potentially provide greater challenge to one’s center of gravity and core musculature engagement when compared to a locked attachment or anchor. It has been shown that suspension bodyweight training exercises increase core muscle activation (8). So, the inclusion of rotational and anti-rotational aspects to suspension bodyweight exercises has the potential to increase instability of the moving handles/cradles, requiring greater focus to stabilize not only the actively engaged joint(s) and musculature, but also the entire core and kinetic chain. This also potentially has the added effect of making stabilization or bilateral equalization more difficult than with a static/locked anchor. Developing core stability can potentially benefit basketball athletes as well because evidence suggests that there is a connection between core stability and athletic performance (10).

The ability to train unilaterally with bodyweight effectively is not an option with a fixed anchor or attachment point on most suspended bodyweight training devices. When single-arm or single-leg movements are performed, the free arm or leg is not actively engaged in the action. However, with rotational bodyweight trainers, athletes can perform unilateral/asymmetrical movements, which require dynamic stabilization and eccentric engagement of the opposite side of the body; this can improve the ability to reduce muscular imbalances by requiring the synergistic stabilizers to work in unison (4).

Because the goal is to develop basketball players who can move optimally in every plane of motion within fractions of a second, training should include elements that can better challenge them in multiple planes, while providing various resistance and proprioceptive challenges. This added aspect of rotation to suspended bodyweight training is a consideration that strength and conditioning coaches could implement into their training programs to potentially improve bilateral symmetry of the basketball players they train. Below are several sample exercises that could be incorporated as a part of the overall programming designed to increase bilateral symmetry.
TABLE TOP (INVERTED ROW) WITH ALTERNATING ROW
This movement engages the lumbar spine as the primary core stabilizer, while allowing emphasis to be placed on rotation and muscular activation of the thoracic spine.

ALTERNATING HAMSTRING CURL
This movement focuses on hip disassociation and the ability to engage the hamstrings and posterior leg musculature asymmetrically.

FIGURE 3. TABLE TOP (INVERTED ROW) WITH ALTERNATING ROW

FIGURE 5. ALTERNATING HAMSTRING CURL

FIGURE 4. TABLE TOP (INVERTED ROW) WITH ALTERNATING ROW

FIGURE 6. ALTERNATING HAMSTRING CURL
STEP BEHIND LUNGE WITH ROW

This is a multiplanar movement that activates the entire body’s musculature while focusing on balance, stability of the lower body, and rotation of the thoracic spine.

REFERENCES


ABOUT THE AUTHORS

Steve Hess is a 17-year professional basketball strength and conditioning coach based in Denver, CO. He is a former co-owner of FORZA Fitness and Performance Center and is one of 12 trainers worldwide who sits on the Under Armour Performance Training Council. He is also the official spokesperson for the National Sports Center for the Disabled and is a member of National Basketball Association (NBA) Team Fit. In addition, Hess has been featured on NBA Inside Stuff, All-Access with Ahmad Rashad, NBATV, The Eating Network, Men’s Fitness, Men’s Health, Celebrity Sweat, and the Altitude Sports and Entertainment Network. A graduate of Ithaca College, Hess received a Master’s degree in Physical Education with an emphasis in Sports Medicine and a Bachelor’s degree in Exercise Science Fitness and Cardiac Rehabilitation, as well as being a Muscle Activation Technique Specialist (MATs).

Chris Camacho has been involved in the sports and fitness industry for more than 20 years. He currently serves as the Director of Education and Programming at CrossCore®. Prior to joining CrossCore, he served as the Director of Fitness Development and Programming for GoFit, Director of Strategic Partnerships for Fitness Anywhere (TRX), Director of Business Development and Sports Marketing for Power Plate North America, and has worked with numerous professional strength and conditioning coaches and programs domestically and internationally throughout his career. Camacho earned his Master’s degree from the University of San Francisco in Sport Management and his Bachelor’s degree in Exercise Physiology with an emphasis in Athletic Training.

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Basketball players engage in strength and conditioning with the goals of maintaining their health and ability to meet the demands of the sport (e.g., running, cutting, changing of direction, jumping, etc.), reducing the risk of injury, and improving performance. However, appropriate manipulation of strength and conditioning programming variables is necessary in order to optimize the potential athletic adaptations. Specifically, exercise choice is a modifiable variable with great influence on the resulting adaptations and subsequent sport performance (6). For this reason, debate exists over whether bilateral or unilateral training is best for eliciting the desired response (1). Bilateral exercises require contraction of contralateral limbs (e.g., bilateral back squat as seen in Figure 1), while unilateral exercises require contraction of one limb individually (e.g., rear foot elevated split squat as seen in Figure 2). Some argue that bilateral training is best given the potential for greater absolute force and velocity generation (2). Whereas others argue that unilateral training is more sport-specific (i.e., running, cutting, and jumping are performed unilaterally), thus making it the superior option. Additionally, it has been argued that the existence of a bilateral force deficit (BLFD), the phenomenon of decreased bilateral force production compared to the sum of unilateral contractions, justifies a unilateral training preference (2). However, the available evidence suggests that the BLFD should have little to no influence on exercise selection (3). It may be wise to select bilateral and unilateral exercises based on how each influences performance. The purpose of this article is to compare single-leg and double-leg training options and provide considerations and potential implications for training basketball athletes.

### Comparing Single-Leg and Double-Leg Training

Research comparing unilateral (single leg) and bilateral (double leg) training provides insight into how each training approach influences athletic attributes (e.g. strength, power, etc.) (1,2,3,4,5,7,8,9,10). A brief review of the literature comparing bilateral and unilateral lower body training allows for conclusions to be made on the effects of single-leg and double-leg training and thus practical implications can be drawn to guide strength and conditioning programming for basketball athletes.

Rube and Secher investigated the effects of five weeks of single-leg and double-leg training on leg strength and fatigue (7). In agreement with the principle of specificity, this study found that single-leg and double-leg training increased strength and decreased fatigue, with no differences between single-leg and double-leg results (7). Interestingly, despite the fact that both legs were trained, single-leg training did not decrease fatigue during double-leg repeated maximal voluntary contractions, and double-leg training did not decrease fatigue during single-leg repeated maximal voluntary contractions (7). These results suggest that improvements in strength are similar between bilateral and unilateral training, while endurance capacity requires specific bilateral and unilateral training, with minimal crossover effect (i.e., unilateral training does not decrease bilateral fatigue and vice versa). Although endurance appears to exhibit training-specific adaptations without a crossover effect, strength and hypertrophy adaptations are not exclusive to the training type (4,5,7,8).
Recently, Botton et al. compared the neuromuscular adaptations of the knee extensors to unilateral and bilateral training in recreationally trained women (5). Subjects trained for 12 weeks performing unilateral or bilateral leg extensions two times per week on non-consecutive days. Both unilateral and bilateral training groups similarly increased unilateral and bilateral knee extension one-repetition maximum (1RM), as well as unilateral and bilateral peak isometric knee extension torque (5). However, the unilateral training group had greater increases in unilateral 1RM than bilateral 1RM, while the bilateral training group had similar increases in bilateral and unilateral 1RM (5). Additionally, the unilateral training group demonstrated greater isometric peak torque increases compared to the bilateral training group, and only the unilateral training group increased muscle electrical activity. No difference in muscle thickness increases existed between training groups. These results suggest that dynamic strength increases and morphological changes are similar between unilateral and bilateral training, while unilateral training appears to potentiate unilateral strength gains as well as electrical activity.

While unilateral and bilateral training can increase both unilateral and bilateral strength, the reported greater increases in unilateral 1RM by the unilateral training group is in agreement with other research. For example, Hakkonen et al. reported an average increase of 19% in bilateral 1RM in the bilateral training group versus an average increase of 13% in bilateral 1RM in the unilateral training group (10). Conversely, an average of 17% and 14% 1RM increase for right and left leg was reported for the unilateral training group, while the bilateral training group had average unilateral 1RM increases of 10% and 11% for the right and left legs, respectively. The same researchers reported non-significant differences in hypertrophy of the quadriceps suggesting hypertrophic effects to be similar between unilateral and bilateral training. Thus, unilateral and bilateral training appear to affect muscle size adaptations similarly, while the magnitude of strength increases seems to be specific to the training type.

In addition to the importance of endurance, strength, and hypertrophy qualities for basketball players, power is perhaps the most desired athletic attribute. McCurdy et al. studied the effects of eight weeks of unilateral or bilateral training on measures of strength and power in untrained men and women (8). Strength was assessed with a 5RM unilateral and bilateral squat test while power was assessed with a unilateral and bilateral vertical jump, as well as the Magaria-Kalamen stair climb test. The researchers reported similar improvements in all tests between the two training groups, with the exception of unilateral vertical jumping performance and relative power, which improved more in the unilateral training group (8). This would indicate that alternate-leg bounding power is equally improved with unilateral and bilateral training, but unilateral power is best improved by unilateral training. Given that alternate-leg bounding improvements do not appear to be training type specific, sprinting and agility qualities may be equally improved by unilateral and bilateral training.

Sprinting and changing of direction are two common tasks required in basketball. In what may be the most practical study comparing unilateral and bilateral training to date, researchers compared the effects of unilateral and bilateral squat training on strength, agility, and sprint performance (4). In this study, 18 rugby players performed rear foot elevated split squats (RFESS) or bilateral back squats twice weekly for five weeks using progressive relative 1RM loads. Subjects were pre- and post-tested for RFESS, back squat, pro-agility, 10-m, and 40-m sprint with results showing equal improvements between unilateral and bilateral training groups in the RFESS, back squat, and 40-m sprint (4). No improvement was seen in the 10-m sprint. These are compelling results demonstrating similar efficacy of unilateral and bilateral training for improving strength, sprint, and change of direction speed.

While the aforementioned data provides insight into unilateral and bilateral training muscle performance adaptations, these studies are limited by short training durations (<8 weeks) and pre- and post-test methods that do not allow for a time course distinction between training adaptations. Makaruk et al. performed a study to distinguish between the effects of unilateral and bilateral plyometric training on muscle performance over the course of training and detraining periods (9). In a group of physically active women, the researchers tested the unilateral and bilateral countermovement vertical jump, a 10-s Wingate test, and a five-jump alternate-leg bound pre-training, mid-training (after week 6), post-training (after week 12), and after four weeks of detraining. Interestingly, the unilateral training group improved in all tests by mid-training but had no further improvements from mid- to post-training, and had substantial decreases during detraining (9). The bilateral training group improved in only the Wingate test and bilateral countermovement jump from pre-training to mid-training (9). However, in contrast to the unilateral training group, the bilateral training group continued improvements from mid-training to post-training in all tests and did not regress from post-training to detraining.

These results indicate that although unilateral and bilateral training can be effective at improving lower body power and jumping ability, the improvements from unilateral training may be more immediate (e.g., 6 weeks) than improvements from bilateral training yet do not continue after initial increases. Conversely, power and jumping increases from bilateral training may take longer (e.g., 12 weeks) than unilateral training, but the adaptations appear to equate over time and last longer (9). These results have important implications for program design when training basketball athletes. Specifically, unilateral plyometric training appears beneficial for rapidly improving performance (e.g., pre-season, competition peaking), while bilateral plyometric training appears to allow for adaptations to maintain through periods of little to no training (e.g., in-season training, injury recovery). Importantly, the results do not suggest that each training type should be performed exclusively, but rather best practice likely warrants the inclusion of both unilateral and bilateral training to take advantage of the unique time course adaptations. Unfortunately, this study did not include strength training so it is unknown whether unilateral and bilateral resistance training follows similar time dependent adaptations as plyometric training.
CONCLUSION
Strength and conditioning participation is meant to allow basketball players to maintain their health, elicit desired muscle adaptations (e.g., endurance, strength, hypertrophy, power), and ultimately improve their ability to meet the demands of their sport (e.g., running, jumping, changing direction). Given the influence of exercise selection on training and performance outcomes, debate exists over whether unilateral or bilateral training is best for developing basketball players. The scientific literature comparing unilateral and bilateral training indicates that both types of training should be used to optimize performance. Endurance capacity (i.e., ability to resist fatigue) improvements appear to be type specific (e.g., unilateral training is required for unilateral endurance and vice versa). While strength and power increases are not exclusive to training type, the magnitude of improvement appears to be dependent on the type of training performed. Increases in muscle size, sprinting performance, and agility are similar between training types. Lastly, considerations must be given to the time dependent response of each training type; unilateral training appears to elicit rapid adaptations while bilateral training may take a bit longer to improve performance but the adaptations appear more resistant to detraining regression. The data taken together indicates that both unilateral and bilateral training should be incorporated into a comprehensive strength and conditioning program to develop basketball players optimally.

REFERENCES

ABOUT THE AUTHOR
Ramsey Nijem is the Assistant Strength and Conditioning Coach for the Sacramento Kings National Basketball Association (NBA) team and is concurrently earning his Doctorate degree in Human and Sport Performance.
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REINVENTING WHAT’S HUMANLY POSSIBLE
The recovery process is one of the most challenging and diverse areas in the National Basketball Association (NBA). Every strength and conditioning coach is in search of the most effective and efficient programs that will provide their athletes with the best opportunity to recover fully. There is no end-all be-all program when it comes to recovery, therefore coaches rely on multiple variables to give their athletes the best chance to recover fully. Many processes and applications are used for recovery programs but there are certain factors that must be taken into consideration before determining the optimal course of action.

One of the most important factors is an athlete’s ability to buy-in and create a routine the athlete will adhere. The psychological aspect is another important factor. For instance, if an athlete is accustomed to utilizing a particular recovery method, the psychological benefit for utilizing that specific method may be effective for that athlete. Older methods may not be the most effective means of recovery in all situations, but the psychological benefit may enhance the overall recovery process for that athlete in particular. Another important factor in the recovery process is an athlete’s health and/or physical limitations. Some methods, such as static stretching, may not be appropriate for an athlete with a muscle strain, similarly inappropriate would be foam rolling a contusion.

Recovery is a never-ending process through the NBA season. Starting from voluntary workouts in August/September, all the way to the playoffs in May/June, the ability for the athletes to recover is extremely important because the NBA schedule is grueling; some teams even play five games in seven nights (back-to-back games, off day, game, off day, back-to-back games). An example of this can be seen in Figure 1, which provides the 2015-2016 schedule for the Detroit Pistons. The second week of December provides an example of five games in seven nights. Oftentimes, the recovery process has to be able to provide athletes with the ability and opportunity to recover in less than 24 hours. The following will break down the NBA season and provide considerations for developing an effective and efficient recovery process to account for the grueling NBA schedule.

TRAINING CAMP
The first part of the NBA season is the pre-training camp timeframe. This is a critical time to develop and implement, as well as experiment, recovery techniques for all athletes to determine what may be the best option for each athlete. As part of pre-training camp voluntary workouts, a useful flowchart tool to determine athlete readiness and recovery for each session can be seen in Figure 2. At the end of this flowchart is a box identifying a checklist of recovery methods. Using this structured system (Figure 3) for readiness and recovery, all athletes must complete a minimum of three recovery methods from this checklist following training sessions and practices. Figure 3 provides a checklist of recovery methods, which include stretching, rehydration, foam rolling, and various types of therapy. Not listed as part of the recovery checklist is inversion therapy and dynamic compression.
devices (2,12). The unmonitored part of recovery is very critical because it relies upon an athlete’s compliance; this is the home recovery process, which consists of continued rehydration, refueling, and most importantly, rest (7).

The recovery program and methods will be put to the ultimate test during training camp when “two-a-day” workouts take place over two to four days, dependent on the organization. Following the morning session, a major emphasis is placed on passive recovery, refueling, rehydrating, and inversion therapy, whenever necessary. This allows the athlete’s body to recover sufficiently by reducing fatigue and enabling the body to ramp back up for the second session (15). After the completion of the last session of the day, all recovery methods are emphasized with dynamic compression and contrast baths and cold/hot showers receiving the most emphasis to help reduce delayed onset muscle soreness (DOMS) (3,11,14).

**PRE-SEASON**

After “two-a-days” and training camp, the schedule normalizes during the pre-season, which is quite similar to the regular season schedule. Practice and home game recovery programs are identical to that of training camp. Some recovery methods will not be available during travel, such as contrast baths or cold-only baths, which can be limited due to opposing team facilities. Therefore, a major emphasis is placed on static/assisted stretching, foam rolling, and rehydrating and refueling. Recovery following away games is critical because the time between game completion and flight departure is when rehydration and refueling has to achieve optimal levels (1). The “anabolic window of opportunity” is the theoretical time after training where muscle adaptation may be optimized. The most touted benefit of nutrient timing is that it can potentiate increases in muscle protein synthesis (9). Whether participating in a game or resistance training, it is often recommended that athletes consume protein immediately following their activity in order to reach a positive protein/nitrogen balance, which helps to build and repair muscle (16). After the flight, the athletes begin the resting stage; whether it is in the form of naps on the way to the hotel or sleeping once they get to the hotel (sometimes rest can occur on the flight as well). In order to facilitate optimal rest, timing for refueling and rehydration should occur before the resting stage. This is done to allow athletes the chance to use the bathroom while still awake so that they may have a better chance for REM (rapid eye movement) sleep, which is also extremely important for recovery (7).

**OFF-SEASON**

The off-season recovery process tends to be broader and longer in duration because there are little to no demands placed on basketball. Participating in basketball and strength and conditioning activities during the off-season is at the discretion of the athletes. This allows the recovery process to be longer than it would be during the season. The physical demands of the athletes are far less during this time of the year even though their training may have more intensity and volume than during the season. The combination of training and competition during the season is far more rigorous than during the off-season. As the off-season begins to close (end of August) and the pre-season (mid-September) approaches, the duration of the recovery process will start to shorten to simulate the upcoming season.

**CONCLUSION**

The recovery process is an on-going, evolving, and important factor influencing athletes’ performance in the NBA. Whether it is new modalities, technology, or modifications to existing methods, this process is one that can only be mastered by looking at all aspects of recovery; which includes mental, emotional, and physical recovery. Strength and conditioning coaches can obtain the latest, trending application of recovery, but at the end of the day, if the athletes do not buy-in, the recovery process for them will become a challenge. Educating the athletes about all the recovery methods will allow them to take ownership and make the decision to choose what he or she is most comfortable with, and assist the coaches in determining what will work optimally for that athlete in a psychological aspect.

**REFERENCES**


**ABOUT THE AUTHOR**

Anthony Harvey is in his 2nd year as the Head Strength and Conditioning Coach for the Detroit Pistons National Basketball Association (NBA) team. Previously, he spent two seasons as the Assistant Strength and Conditioning Coach for the Orlando Magic NBA team. He is responsible for the design and implementation of programs to address the Piston’s need for strength, power, conditioning, and overall performance. Harvey earned his Bachelor of Science degree in Health Science Pre-Physical Therapy at Florida Agricultural and Mechanical University. He holds certifications with the National Strength and Conditioning Association (NSCA) as a Certified Strength and Conditioning Specialist* (CSCS®) and Registered Strength and Conditioning Coach (RSCC), as well as Performance Enhancement Specialist (PES) and Corrective Exercise Specialist (CES) through the National Academy of Sports Medicine (NASM).
### DETROIT PISTONS 2015-16 SEASON SCHEDULE

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**Note:** All games are listed in Eastern Time.
**THE RECOVERY PROCESS**

**FIGURE 2. ATHLETE READINESS FLOWCHART**

**FIGURE 3. RECOVERY CHECKLIST**

**Foam Roll (11,14)**  
*Protocol:* 1 set of 30 – 90 s hold  
*Areas to target most often:* IT band, groin, quadriceps, gluteals, piriformis, low back, latissimus dorsi

**Ice Therapy (5)**  
*Protocol:* Apply ice 15 – 20 min  
*Areas to target most often:* Knees, ankles, shoulders, wrists

**Cold Shower/Hot Shower (3,15)**  
*Protocol:* Contrast 30 s hot and 30 s cold for 5 – 10 min

**Hydration/Recovery Drink (1,17)**  
*Protocol:* Consume a minimum of 40 – 80 oz of water (depending on individual bodyweight)  
*Secondary protocol:* Consume 20-oz protein drink

**Contrast Bath (Cold Tub/Hot Tub) (3,6,15)**  
*Protocol:* Alternate between cold and hot water immersion every 2 – 3 min for a total of 12 – 15 min  
*Secondary protocol:* For cold tub only; 12 – 15 min

**Pool or Water Therapy (4)**  
*Protocol:* 10 – 15 min of supervised recovery exercises in pool  
*Secondary protocol:* Must utilize rehydration protocol while in the pool (40 – 80 oz of water)

**Stretching (7)**  
*Protocol:* Determine optimal stretching method for athlete based on recovery goal (static vs. assisted)  
*Areas to target most often:* Lower body – hamstrings, groin, gluteals, IT bands, quadriceps  
  Upper body – pectorals, latissimus dorsi, shoulders, abdominals, low back, trapezius, arms, low/upper back  
*Secondary protocol:* Upper body static stretch using bands, stability ball, and wall
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The sport of basketball is constantly changing, which means that strength and conditioning programs at the National Basketball Association (NBA) level have had to adapt and adjust with the changing times. Whether it is working with players in team facilities or working with them in foreign countries, a strength and conditioning coach must be willing to go the extra mile when trying to cull the most out of an athlete’s potential.

With the explosion of money and media exposure in the NBA, there is more pressure than ever on athletes to reach their maximum potential—both for the good of the individual player and for the overall team performance. Team owners, general managers, and coaches want that improvement to come sooner, rather than later, because of the often volatile nature of professional sports and the “win-now” mentality that persists. For instance, it’s commonplace that the day after the final game of an NBA season, players conduct exit interviews with management, coaches, and the sports medicine staff in order to get their evaluations and expectations for the following season. In the NBA, there is a lot of pressure on athletes to be their best, and some of that pressure falls onto the shoulders of the strength and conditioning coach. Success or failure often rides on an athlete’s improvement and a strength and conditioning coach’s ability to maximize their talent. Therefore, the strength and conditioning coach is tasked with getting the most out of the athletes at all times of the year, including the off-season regardless of location.

TRAVELING ABROAD

One challenge to training NBA players occurs when the athletes return to their respective homes during the off-season. Rather than simply trusting that the athletes will follow the strength and conditioning program as planned, strength and conditioning coaches often have to travel far to visit players to make sure that they are using the off-season as time for improvement. For example, Bar, Montenegro is a city off the coast of the Mediterranean Sea with no direct route from Orlando, FL (location of the Orlando Magic NBA franchise). Traveling to Bar Montenegro during the summer can take approximately 12 hours of connecting flights and driving. However, working in-person with the athlete is invaluable to a strength and conditioning coach so I have made this trip overseas. By making this trip, I was able to experience the benefits of communicating directly with the athlete, seeing firsthand what training options were available to the athlete, and supervise proper training sessions. I found that despite the difficulties involved with traveling, the entire experience can be very beneficial—for both the strength and conditioning coach and the athlete.

Planning and communication must take place before traveling abroad to be efficient. Before making a trip abroad, there should be communication in regards to the upcoming training sessions and scheduling. One goal should be for the strength and conditioning coach to answer as many questions in regards
to training before their arrival. One of the most common training limitations is the size of the equipment compared to the equipment at the team’s training facilities. Other limitations include language barriers (including reading the equipment displays), hours of operations in which nutrient timing/intake can be affected, and facility size. All of these obstacles can present a challenge for the strength and conditioning coach to overcome, yet they are conquerable obstacles.

COMMUNICATION

If the strength and conditioning coach is unable to travel to an athlete’s home, then they can still communicate with the athlete in various ways. In this situation, strength and conditioning coaches often must rely on certain apps or programs that allow them to communicate via text or video. Apps such as Whatsapp®, Skype®, and Visualcoaching® Pro can allow the athlete and the strength and conditioning coach to communicate from any place in the world, without any expenses. These are great tools to bridge the gap between the strength and conditioning coach and the athlete because they help strength and conditioning coaches prescribe individualized, sport-specific programs remotely. These programs can be easily followed on a smartphone or tablet with an internet connection. For example, the program can be queued to notify the athlete of the specific training program for that day. For any questions they may have regarding the prescribed program, there are illustrations and videos that can help explain the exercises. If the athlete has any concerns such as limitations with certain pieces of equipment or time of the session, the strength and conditioning coach can simply go online and make the adjustments, which are then updated instantaneously on the athlete’s smartphone or tablet.

CONCLUSION

Despite the usefulness and convenience of being able to communicate at all times throughout the world with cutting-edge technologies, nothing can compare with face-to-face interaction. For this reason, most strength and conditioning coaches in the NBA visit their players overseas to monitor their training. Traveling overseas to administer a strength and conditioning program can be an immensely beneficial experience for both the strength and conditioning coach and the athlete. It can help build a strong rapport between the strength and conditioning coach and the athlete, which can ultimately build more trust and adherence to the training program. Even though there may be some challenges involved with traveling, the experience may help the strength and conditioning coach to make better decisions in the future, thereby improving athletic performance.

ABOUT THE AUTHOR

Bill Burgos is currently in his third year with the Orlando Magic National Basketball Association (NBA) team. This is his 5th year as the Head Strength and Conditioning Coach, including working for the New York Knicks NBA team. He is responsible for the design and implementation of strength, conditioning, flexibility, and team nutrition programs to optimize the health, performance, and overall fitness of the players. Prior to his time with the Knicks, Burgos completed a two-year stint with the Magic as the Strength and Conditioning Coordinator working alongside current National Basketball Player’s Association Director of Science and Research, Joe Rogowski. Burgos also served as an Assistant Strength and Conditioning Coach with the Pittsburgh Pirates Major League Baseball (MLB) club for two years. With the Pirates’ minor league team, Burgos was in charge of overseeing the design and implementation of all strength and conditioning activities from the Major League to Rookie Ball levels at their spring training facility in Bradenton, FL. Burgos has a Master of Science degree in Exercise Science from Austin Peay State University, where he also obtained his undergraduate degree in Exercise Science. He obtained his second Master’s degree in Human Movement from AT Still University. Burgos also served for a combined 13 years in the United States Army and United States Air Force in which he deployed to Afghanistan and Iraq during Operation Enduring Freedom and Operation Iraqi Freedom.
College basketball season begins around the time that pumpkins appear in stores and student-athletes face the consequences of their mid-term grades while continuing through multiple major holidays prompting discussions of family traditions. Fall semester final exams, holiday celebrations to end one year and begin the next, and the start of the spring semester all take place before conferences host their end-of-season basketball tournaments. Depending on each school’s academic calendar, those conference tournaments may occur around spring break and spring semester midterms, both of which are significant dates for student-athletes. All of those events are going to occur regardless of how well the team, or individual athletes, perform. Therefore, finding ways to maintain motivation is critical to the success of both individual student-athletes and the team.

Motivation should not only be viewed from a quantity (e.g., a player does not have enough motivation) component, but also from a quality (e.g., effectiveness of motivation) component. A variety of theories have been developed to explain motivation, including the coach-athlete motivational model, achievement goal concepts, competence-motivation, and self-determination theory (SDT) (1,4,5,6,8,9). SDT is one of the most prominent theories; therefore, the remainder of this article will focus specifically on identifying key components of SDT and providing possible examples that strength and conditioning coaches may find useful in order to maintain athlete motivation throughout the collegiate basketball season (3).

BACKGROUND ON SDT
SDT is a comprehensive theory that has been applied in a variety of settings (7). SDT specifically addresses the quality of motivation by identifying a continuum that includes amotivation and multiple versions of both extrinsic and intrinsic motivation. There are several mini-theories involved in SDT, including the cognitive evaluation theory, organismic integration theory, causality orientations theory, basic physiological needs theory, goal content theory, and relationship motivation theory (1,9). For the purpose of this article, the focus will be on the mini-theory known as the basic needs theory. The basic needs theory contains the three psychological needs of competence, autonomy, and relatedness. Competence is when athletes are able to demonstrate their skills and abilities. Autonomy refers to the degree of control athletes have over their experience. Relatedness is a feeling of being connected to coaches and teammates. These three components are thought to be universal across all demographic categories and strength and conditioning coaches can directly affect them as a coach.

Student-athletes demonstrate and develop competence from a variety of sources, both academic and athletic. On the athletic side, research has explored the specific sources of sport confidence and areas that strength and conditioning coaches can consider for adjustments (10). The sources identified are demonstration of ability, mastery, physical and mental preparation,
physical self-presentation, social support, vicarious experience, coach's leadership, environmental comfort, and situational favorableness (10).

The idioms of “catch them doing something good” may be a helpful reminder when thinking about helping athlete motivation in terms of competence. Every repetition on every set of every exercise is a chance to point out high effort or spot-on technical execution. The expectation here is not that a strength and conditioning coach monitors all athletes for all repetitions and constantly tells them how great they are. Instead, the expectation is that each athlete knows what the strength and conditioning coach feels they do well and that some member of the staff mentions that to them at various points. For example, the tall athlete that consistently gets good depth on a squat needs to know that the strength and conditioning coach noticed that depth and approved. This type of acknowledgement and approval can help build the confidence level of that athlete. It is also an opportunity to reflect on coaching skills. For instance, how many athletes know what the strength and conditioning staff feels is done well during training? This may also be an area to help graduate assistants and interns improve their coaching and attention to detail by having them identify the best lift of a session, the highest energy contributor, best spotter, or another component that is appropriate for a session or team.

Opportunities for athletes to improve their confidence do not always have to come verbally from a coach. A systematic goal-setting approach has been used with teams for on-field performance, which could be adapted to focus exclusively on training (2). Specific to athlete competence, the idea of goal setting is that the athlete has upfront, objective goals for each session. Accomplishing those goals provides the positive feedback that allows confidence levels to increase. Employing a systematic goal setting approach does require a time investment from the strength and conditioning coach in order to make each athlete’s goals specific, but once the program is in place it should reinforce itself and continue with a relatively small time investment. Another option is to remove a majority of the input from the staff by giving team members the responsibility of identifying high-energy contributors or the best lift of the session. This could be highly detailed by providing technique checklists for the athletes to evaluate their teammates. It can also be used in a less formal manner that pairs upperclassmen with lowerclassmen, or starters with reserves, to increase certain individual’s connection with others. Adjusting the pairs based on how the season is going or the team’s current needs may be the most effective coaching practice and it may play a role in establishing relatedness as well.

**AUTONOMY**

A good way to think of the concept of autonomy is to picture a leaf floating in the wind. That leaf has absolutely no autonomy, or self-control, over where it goes. That is the exact opposite of what should happen with athletes. Ideally, a strength and conditioning coach should foster an environment where athletes are allowed to make some decisions, but whatever decisions the athletes make should result in beneficial training sessions. Much like how the coach and administration decide how to establish discipline, how much choice is built into the training program is a reflection of the coaching style and philosophy of the strength and conditioning staff. The key here is to reflect on coaching skills and identify the situations with the best possibilities of increasing athlete autonomy.

The following questions are meant to help strength and conditioning coaches reflect on ways to include athlete choices in training sessions. Due to the variety of facilities and localized variables specifically relevant to each coach, not all of the following questions will apply, but these questions should spur some thought about possible options. Can the location vary for where the cardiovascular conditioning takes place (e.g., at a track, on campus, at a field, etc.)? Is the staff willing to allow the exchange of one exercise for a similar exercise (e.g., flat barbell press swapped for flat dumbbell press)?

Being creative with what the athletes wear during training sessions may not only provide a chance for the athletes to have a little bit of control over the experience, but it may also provide some fun to help break up the gloomy winter days of a long basketball season. Even something as simple as allowing the athletes to select which corner of the court they begin their dynamic warm-up from is one way to allow the athletes some level of autonomy. The key message here is to find some opportunities where strength and conditioning coaches are comfortable ceding some control to the athletes. Increasing athlete autonomy can be a great coaching tool, as long as it does not threaten or detract from the strength and conditioning coach’s goals.

**RELATEDNESS**

In the context of SDT, relatedness is about the athlete having a connection to the other players, the sport coaches, and the strength and conditioning staff. The objective is to create meaningful connections and a sense of belonging that goes beyond basketball or training-specific circumstances. The standard to achieve is not best friends, life-long comrades, or even some abstract vision of respect; rather, the goal is simply to achieve and maintain a meaningful connection.

At the center of relatedness are interactions between people. The role of the strength and conditioning coach may be centered on providing an opportunity for those interactions to occur in a comfortable environment. Depending on the coach’s context, there are many ways to create groups for training sessions. For instance, can training sessions include the men’s and women’s teams training together? Can a local high school or club basketball team be brought in to train with the college athletes? Giving some autonomy to the athletes in selecting the clothes they train in by having different subsets of athletes wear different clothes can be a way of creating relatedness. As an example, the frontcourt players could all wear red tops and the backcourt players wear green tops around Christmas time. Similarly, clothing could be used for other holidays (e.g., orange shirts for pumpkins) or special events (e.g., snowflakes for winter).
MAINTAINING MOTIVATION FOR COLLEGIATE BASKETBALL PLAYERS

Even though it may sound like a silly suggestion, remember that the objective of relatedness is to build a connection. The athletes may need to spend time together away from practice and training to create or plan their clothing, which could help tremendously in terms of establishing a connection. Carrying the idea forward over a number of seasons is a way to establish and build a culture that can effectively improve connections between returning players and new additions to the team.

Meaningful connections can involve the strength and conditioning staff, too. In fact, that may be the best way to help jump start the athlete-to-athlete connections. Pairing athletes for a training session based on hometown, places they have traveled to, favorite hobbies, even favorite cookies, or anything they might have in common is a simple way to start. Staff members getting involved in the conversation by telling a story of a trip, or their hobbies can serve as another conversation topic for the players with each other and with the strength and conditioning staff. It may seem strange to talk about cookies, but that next road trip when there are cookies at the hotel or in the buffet line, the athletes may remember the conversation they had about cookies. Providing opportunities for conversations that are not just based on the training, practice, or a game at hand is what relatedness is all about.

CONCLUSION

Competence, autonomy, and relatedness are three keys to promoting a more intrinsically motivated athlete. These components can be combined in nearly limitless ways, which is especially important for basketball student-athletes with a lengthy season. Consulting with a qualified, certified sport psychology consultant may provide additional guidance or more ideas based on localized facility, staff, and athletes. Some recommendations can be found below for strength and conditioning coaches to help motivate their athletes:

• Reflect on coaching practices within the context of providing athletes opportunities to develop competence, and exercise some control over their training to make meaningful connections with others.
• List possible ways for athletes to demonstrate competence, exercise autonomy, or build relatedness.
• List current methods that may impair athletes’ opportunities to demonstrate competence, exercise autonomy, or build relatedness.
• Identify the changes that are viable for the specific facility and the athletes.
• If you identified more than one change, implement the changes in steps according to an overall plan rather than all at once.

REFERENCES


ABOUT THE AUTHOR

Andy Gillham owns and operates Ludus Consulting, LLC, which focuses on performance enhancement for athletes, coaches, and business executives. Of specific note is his work with coaches and athletic administrators on improving systematic coach evaluation and providing targeted coach development opportunities. Gillham is a Certified Strength and Conditioning Specialist® (CSCS®) through the National Strength and Conditioning Association (NSCA) and a Certified Consultant through the Association for Applied Sport Psychology (CC-AASP). He serves as a sport psychology consultant for collegiate teams and coaches as well as individual athletes competing at high school and college levels in the United States and Canada. Gillham is an Editorial Board member for two peer-reviewed journals, the International Journal of Sports Sciences and Coaching and the International Sport Coaching Journal. Gillham earned both his Bachelor of Science degree in Fitness and Master of Science degree in Human Performance from the University of Wisconsin-LaCrosse. He received his PhD in Education with a Major of Sport and Exercise Psychology from the University of Idaho.
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USE CODE: NSCA AT CHECKOUT
For newcomers to the National Basketball Association (NBA), navigating through the season is one of the most difficult challenges they face. Regardless of one’s position within an organization, the schedule is something that impacts many daily decisions and the overall training philosophy. This is no more true than with the strength and conditioning coach, whose success is predicated on structure and progression.

Having worked as a strength and conditioning coach in the NBA for close to a decade, not only have I been able to seek advice from my peers, but I have also been able to test different approaches to training as it pertains to scheduling. The purpose of this article is to present the NBA season cycles in order to provide a better understanding of the yearly requirements and an appreciation for the amount of time and effort strength and conditioning coaches invest into the success of their teams.

Obviously, there is no one right way. Some coaches will shorten phases and extend others based upon both personal and team philosophies. However, the overall NBA schedule remains the same. Also, it is important to note that a successful NBA strength and conditioning coach needs to be flexible because of the ever-changing schedule. This is something I had to learn quickly during my first season. I realized how many different and unforeseeable variables there are in the course of a week, let alone an entire season.

The scope of this article only includes strength and conditioning routines as they relate to basketball-specific resistance training. Obviously, other factors should be accounted for, such as injury prevention exercises, muscle activation exercises, physical therapy, and extra conditioning.

**THE PRE-SEASON (AUGUST – OCTOBER)**
Pre-season is the time of year that coaches have the most individual time with the players and can address specific issues while working on overall strength and power. At this point in the season, the priority of strength and conditioning is to prepare the players’ bodies for a long season. This is the time of year to form the strength and conditioning base from which to progress throughout the year. With the lack of games and travel during this time, it is often possible to have a progressive schedule that is consistent and structured. During my time as a strength and conditioning coach in the NBA, my programs emphasized pre-season training. I generally designed three- or four-day splits depending on the player, experience, and goals, and then added a few conditioning days to address aerobic capacity. From my experience, the majority of avoidable soft tissue injuries occurred in the first few months of the season; it was imperative to have the players in sound shape to limit their chances of injury and keep them focused on playing basketball.

Players would return for pre-season training anywhere from the beginning of August to the end of September; the younger players generally returned earlier than the veterans. Generally, it worked best to start slow with the players during their first week back and try to gauge their current physical condition to how it compares to the previous year. I would start by measuring body fat and body mass, and discussing short-term goals.
I would always provide weekends off because some players would travel back home to visit their family and recoup for an upcoming week. For training purposes, the less a player would travel during this training period the better. However, this time often represented the last chance that players would get to spend quality time with their families before the season and, mentally, this had a profound positive effect that outweighed the possible negative effect of jet lag. During the weekdays, the players would generally arrive anywhere between 8:00 am – 12:00 pm, and engage in basketball skill work either before or after lifting. During this time, they also tried to complete all their pre-season testing and physicals before training camp, which took place during the first week of October.

The other aspects that required attention during this period were individual basketball workouts and pick-up 5-on-5 games. This is why it was imperative to have an open dialogue with the director of player development or whoever is controlling the workouts at that point in the season. I would collaborate with this individual on how we to condition the players before and during the season. Sometimes it would be on the court during the skill work or 5-on-5 games, and other times it would be during training on the track or in the boxing ring. However, we made sure to communicate so that we were not doubling up on their conditioning and inadvertently overloading the players.

**IN-SEASON (OCTOBER – APRIL)**

During the NBA season, strength and conditioning coaches do not have a tremendous amount of time to work with the players, so it is important to be as efficient as possible. It is important to be flexible due to changes from variables like travel, injuries, and trades during the season. The following is what I incorporated into my training schedule to help me deal with some of these variables. One strategy I incorporated was lifting on game days; though this was sometimes limited by the quality of the weight rooms in various arenas.

Once the season started, my normal approach was to get all the players on a consistent lifting routine. Generally speaking, I would try to get my young players to lift four times per week and my veterans to lift at least two times per week—some weeks we were able to get three or four lifts depending on the schedule and physical condition. The young players would typically have longer workouts of about 45 min to one hour. Those playing a lot of minutes in the games would generally be limited to 30 min to finish their lifting routine.

I preferred to have both the rotation and non-rotational players lift the day of a game, though the approach was slightly different for each. I was always fortunate to have a quality weight room in my home arena that I could access before and after games, but that is not always the case for every strength and conditioning coach. The non-rotationals would usually lift for a couple of hours before games. These players were not likely to play, so we would get a quality lift in, whenever possible. Also, being later in the day, their bodies were awake and warm so they could typically get a better lift in compared to working out in the morning. Perhaps a couple times per year because of circumstances in a game, these guys would get playing time in the evening after a training session. Generally, it was not a lot of playing time and if they had been doing this routine long enough they were not fatigued during the game. However, if they started playing more regularly, then their training would be adjusted accordingly. What I found interesting was that once players got into a routine of lifting before games, they reported that it made them feel better and more alert.

The rotation players typically had more flexibility as to when they did their strength training. I gave players flexibility in choosing the time of day during which they lifted because, psychologically, if the players did not buy into the time of day they lifted, it would probably not be a quality lift anyways. In addition, some players had family responsibilities that made lifting at certain times difficult.

I presented my rotation players the option of lifting after a game. Initially it was a tough sell, but they eventually bought in once I explained to them that it would be quicker than a pre-game lift because they would not need to do all the warm-ups and, more importantly, they would get the next day off from strength training to fully rest their legs.

After games, players were already warmed up and loose, and could jump right into lifting, cutting the amount of time in the weight room in half. For example, in terms of a recovery day, rather than playing Sunday, lifting Monday, and playing Tuesday without resting their legs, they had Monday to recover their legs after getting their workout in the night before. At some points in the season, I would have ten players lifting after a game. First, this says a lot about the character of the players and that team, but it also says something about this method because the players obviously felt it benefited them. If the players did not see a benefit in lifting after home games, they definitely would have to let me know.

As the in-season equates to a lot of traveling, I tried to get the bulk of our lifting completed at home. Personally, I found the quality was much better at home than on the road. While traveling, we never really knew what equipment we would have access to or if we would have the necessary time. There were situations when the team would be gone for a week and we would have to do some type of team lift. Sometimes, I had to be creative. For example, during the warm-ups for practice, I would add some band work or plyometrics. However, for the most part, if it was just a quick two-day trip, I would wait until we got back home to do the bulk of our lifting. The non-rotation guys were the exception because I had more time with them and did not have to manage game recovery. I tried to keep the players training as consistently as possible despite being limited by equipment and travel.

This in-season method happened to work for my particular team setting, but may not work for all. I know many strength coaches who successfully employed different strategies. I always tried to be open-minded in terms of our in-season training schedule. With the constant turnover of players, staff members, and the new schedule, I was constantly adjusting for the new season. I needed to come up...
with a strategy that would give our players the best ability to get in a good lift on a consistent basis.

THE OFF-SEASON (MAY – JULY)
One of the busiest times of year for the strength and conditioning coach in the NBA is the off-season. For most teams, the season ends in the middle of April (the regular season) or a couple of weeks later in the playoffs. Each year, a few teams have the pleasure of playing into June and competing for the championship, which is a consideration that should be taken into account as the end of the season nears.

Generally speaking, as soon as the season would end, I liked my rotation players to get away and refresh both physically and mentally. I would have them stay active with some sort of fun activity, while being careful to avoid burning out. I would like them to start lifting in June to establish their base for the next season. In July and August I would start implementing some conditioning. Each player was different in the amount of time it took to prepare for the season. That is why it was important to keep an open dialogue with them throughout the summer.

Every year in May the NBA Combine occurred, which all strength and conditioning coaches generally attended unless they were still in the playoffs. Even then, an assistant would go in their place so as not to lose valuable contact time with potential draft prospects. Following the Combine, teams would bring in draft prospects right up to the day of the draft, which was at the end of June. Teams may bring in anywhere from a couple of players to over 80; because each organization had their own approach and method to player evaluation, the approach was often very different. Teams were allowed to bring in no more than six draft prospects per day. These prospects were subjected to individual team performance testing conducted by the strength and conditioning staff and court work conducted by the coaching staff. Management would then use the data collected during the performance testing as a resource during the draft selection process.

The difficult part for strength and conditioning coaches was that the draft coincided with the training of current roster players competing on the summer league team in July. Usually these players started training at least a month prior on a standard Monday through Friday summer schedule. Time management was crucial at this time of year. I would generally have the summer league players train in the morning and the draft prospects in the afternoon. It was not uncommon for draft prospects to come in on the weekends.

After the summer league games in July, I would visit veterans in their respective cities to monitor some of their training. Some teams began to organize team camps at this time, which was a tremendous help because it allowed me to check in with all of the players at once. Most strength and conditioning coaches take their vacations at the end of July or the beginning of August, before the players start to come back in August and September.

CONCLUSION
This outline is an oversimplification of an NBA season from the perspective of a strength and conditioning coach. The variables of an NBA season constantly change, which requires strength and conditioning coaches to adjust accordingly. Just as the NBA season is different, so are the individual teams in the NBA. Each individual’s approach to scheduling might be different with a young team compared to a team of veterans. The success of the program is often heavily influenced by the coach’s ability to combine strength and conditioning principles with common sense and their ability to adjust to the yearly schedule.

ABOUT THE AUTHOR
For over fifteen years, Joe Rogowski has worked in a variety of sports—including soccer, football and basketball—developing and evaluating strength and conditioning protocols for players. Currently, he is the Director of Sports Medicine and Research for the National Basketball Player’s Union. For several years, he served as the Head Strength and Conditioning Coach for the Orlando Magic and, most recently, was the Director of Science and Research for the Houston Rockets. Rogowski’s published work includes articles relating to injury prevention, strength and conditioning, performance analytics, and echocardiology. He was an adjunct instructor in Exercise Physiology at the University of Florida and served as President of the National Basketball Strength Coaches Association (NBSCA). In addition, he has served served on the NBA Science Advisory Committee and the NCAA Cardiac Task Force. Rogowski is a graduate of DePauw University and received a Master’s degree in Exercise Physiology from the University of Central Florida.
The 39th Annual NSCA National Conference is bringing together the best of the best from all reaches of the strength and conditioning industry to bridge the gap between innovative science and power-packed applications in exercise and athletic performance. From cutting-edge presentations to dynamic hands-on sessions by renowned professors, researchers, strength coaches, and personal trainers, you'll gain the tools to elevate your strength and conditioning skillset and help your athletes achieve their greatest potential.
Basketball is a sport that requires a combination of power, speed, strength, and endurance. The season consists of multiple games per week with very few days off. With each season lasting several months, recovery nutrition can play a huge role in basketball athletes maintaining their health and fitness. Throughout the entire year, they are often very active. Whether they are participating in competitive games, extra shooting practice, agility drills, or rehabilitation, all of these activities contribute to extremely high energy needs which can be difficult to maintain without proper nutrition. The following are nutritional considerations for fueling basketball athletes properly.

**CALORIC INTAKE**

Due to the metabolic demands of basketball, many basketball players do not like feeling “heavy” on the court. Often these athletes will consume smaller portions at each meal to avoid feeling heavy. However, this may not provide enough energy intake for the athletes based on the demands of the sport. One method to avoid this and ensure that they meet the energy demands is to increase their “fuel frequency” to 5 – 8 times per day (including meals and snacks) rather than 4 – 6 times per day.

It can be a challenge for basketball players to meet the fuel recommendations for their sport, especially those trying to gain weight. Optimal fueling can be hampered by both high energy expenditures and moderate mealtime appetites. The following strategies can be used for athletes trying to meet this high energy demand:

- **Drinking calories:** This includes low-fat dairy, 100% fruit juice, and smoothies.
  - Consuming 100% fruit juice instead of milk at meals may prevent the athlete from feeling satiated from the protein in the milk and allow them to finish their entire meal. However, milk can be used to increase caloric intake if taken with snacks, for instance.
- **Eating every 2 – 3 hr:** This may allow athletes to meet their caloric needs without feeling too full at any one point.
- **Breakfast is a must:** This is a critical 500 – 1,000 calories that athletes could be missing out on if it is not made a priority.
- **Emergency snacks:** Athletes should keep snacks in their car, gym bag, etc. so they can fuel between meals, especially if it is going to be longer than 3 – 4 hr until they can eat again.
- **Nighttime snacks:** Basketball players are usually up late in the night as they are used to having a lot of night games.
  - Take advantage of this and encourage a nutrient-dense snack or “mini-meal” for those who struggle to maintain or put on weight.
  - Consume protein right before going to sleep at night because it may help with improving lean body mass.

The fuel frequency aspect of a basketball player’s diet is important as it can aid in overall body composition and physical performance. Increasing meal frequency may help prevent skeletal muscle protein catabolism (i.e., loss of muscle mass). If an
athlete is working on specific body composition goals, whether attempting to gain or lose weight, the focus should be on nutrient quality and adjusting portion sizes.

Carbohydrate and protein needs are dependent on bodyweight and are individualized based on each athlete and their goals. These needs are dependent on activity level and body composition goals. In general, carbohydrate needs for a basketball athlete is a range of 7 – 9 g/kg of bodyweight per day while protein needs can range between 1.4 – 1.7 g/kg per day (1,16). Table 1 provides recommended amounts of carbohydrate and protein for a 180-lb and 210-lb basketball athlete.

Carbohydrate intake is especially important to avoid late-game fatigue and to fuel the short bursts of movement common in basketball. Foods that are high in carbohydrates include whole grain bread, oatmeal, cereal, bagels, pasta, brown rice, potatoes, low-fat yogurt, milk, and 100% fruit juices. These types of foods should be encouraged regularly to ensure the basketball athlete is optimally fueled.

**BODY COMPOSITION**

Although body composition is largely individualized, some position-specific trends can be seen in basketball athletes. For instance, centers tend to have a higher body fat percentage than guards and forwards; however, they also tend to have a greater amount of fat free mass (FFM) (16). The greater amount of FFM can likely be attributed to the higher absolute weight of the centers. This trend is true of male and female basketball athletes (16). The heavier build of a center is more useful for the physicality of low-post work (16). Table 2 summarizes data from a review where most body fat percentages were measured for male and female guards, forwards, and centers using calipers (16). It should be noted that the results of one body composition measurement tool should not be compared to another, as the standard of error is different for each type of measurement tool utilized.

**HYDRATION**

Hydration is an important component for all athletes and can have a particularly important effect on basketball performance. Dehydration is categorized as a fluid loss of more than 2% of bodyweight during activity (2,8). Fluid losses should be replaced to return to euhydration, or an adequately hydrated state (2). The following list shows the impact dehydration can have on basketball performance (3,4):

- Slower time to complete basketball-specific movement drills (e.g., defensive slides, sprints, jumps, etc.)
- Fewer shots made
- Slower reaction time
- Increased omission and commission errors

Dehydration may also increase the risk of injury, muscle fatigue, and cramping (2). The short bursts of intense movement in basketball are associated with heavy sweat losses, which make basketball athletes prone to dehydration (11). Osterberg et al. showed that sweat losses were as great as 2 L in a game (approximately 20 min of playing time) and that half of the basketball athletes (n = 29) started a game in a dehydrated state (11). The ad libitum (i.e., at one’s pleasure) fluid intake during playing time was 1 L, which did not compensate for their dehydrated state before the game (11).

During practices, consuming sports drinks is an ideal method for providing both carbohydrates and electrolytes to help sustain performance and replenish what is lost during activity. It is important for athletes to test for tolerance of sports drinks prior to games. It is recommended to establish a hydration routine during practices to ensure optimal performance during games. For those who frequently cramp or lose a lot of fluid during practices, sports drinks can be used after practice for fluid recovery. The sodium and carbohydrates they provide will help the body retain fluids that are being consumed (8,13). Sodium and carbohydrates may also be obtained through food. Athletes can also be encouraged to add salt to their meals to increase sodium intake, if needed. Salty snacks include trail mix, pretzels, peanut butter crackers, beef jerky, and popcorn. Hydration status can be assessed with a urine specific gravity (USG) test. A USG of ≥ 1.020, or fluid loss during activity of more than 2% of bodyweight, is indicative of dehydration (2).

**RECOVERY**

A basketball athlete’s body goes through substantial wear and tear; they have a long season, play a lot of games, and their legs are heavily relied upon when it comes to jump shots, rebounding, and moving up and down the court. Therefore, recovery is very important for basketball athletes to stay fresh.

To recover from glycogen-depleting activities, a basketball athlete should have 1.0 – 1.5 g of carbohydrates/kg of bodyweight post-exercise (12). Simple carbohydrates achieve a higher amount of glycogen synthesis. Consumption of protein provides amino acids for muscle repair and encourages a more anabolic hormonal profile (i.e., muscle building) (1). Even if an activity is not enough to be “glycogen-depleting,” including recovery fuel and fluids after practices and workouts may help prevent weight loss associated with the smaller appetites and high energy expenditures common in basketball athletes. Regarding protein amounts, 20 – 25 g per serving have been shown to stimulate muscle protein synthesis (12). Larger athletes may need more, but excessive amounts are not necessary. Some food examples of post-exercise recovery snacks are low-fat Greek yogurt and granola, a peanut butter and jelly or deli meat sandwich, or a bowl of whole grain cereal with low-fat milk.

Liquid forms of protein may be optimal for some athletes due to rapid digestion rate, ensuring entry into the system during post-exercise recovery (12). Liquid forms of protein are also convenient for athletes who are tired, do not have an appetite, or are in a rush and need something quick and convenient.
SLEEP
Basketball is a sport where the majority of games are at night, which means the athletes’ wake and sleep schedules are pushed back much later than most. Sleep schedules are often inconsistent depending on what their schedule is like for the next day. Classes, tournament play, practice times, and travel can all factor into how much sleep basketball athletes get each night and when they wake the next morning. Often during breaks or off-days, they will sleep until the early afternoon, which may narrow their window to fuel their bodies enough to maintain and recover properly. They should be educated on making fueling a priority during these times to ensure they maintain muscle.

If basketball players are not able to sleep in they could be at risk for insufficient sleep. This may add just as much of a challenge to maintaining body composition and athletic performance as any other factor. Mah et al. found shooting accuracy improved with an increase in nightly sleep time (10). Both free throw percentage and three-point field goal percentage increased by 9% (10).

The restoration of muscle glycogen stores appears to be hindered by more than 30 hours of sleep deprivation (15). Sleep deprivation can be defined as prolonged periods of time without sleep. This does not seem far outside the box for basketball athletes considering their hectic schedules and travel itineraries (6). Their late wakeup times also throw off a typical day of eating. These athletes should be educated on the need to fit in enough high-quality calories to maintain muscle mass.

VITAMIN D
Basketball athletes are at risk for vitamin D deficiency, which puts them at a higher risk for stress fractures, skeletal muscle pain, and respiratory tract infections (5). Since sun exposure has the greatest impact on vitamin D levels, basketball athletes are at risk for insufficiency due to indoor participation limiting their sun exposure. Vitamin D synthesis is triggered endogenously (internally) when ultraviolet rays are exposed to the skin. Athletes with darker skin pigmentation and tones do not synthesize vitamin D as well as others, which puts them at even higher risk for insufficiency (9).

Many experts suggest the current Recommended Dietary Allowance (RDA) for vitamin D, which is 600 international units (IU), should be set higher (7,9,14). However, studies have shown that athletes’ diets in the United States often do not even meet 200 IU per day (7,14). Naturally occurring vitamin D-rich food sources include swordfish, tuna, egg yolks, salmon, mushrooms, and sardines. Foods fortified with vitamin D include milk, yogurt, margarine, cereals, and orange juice.

CONCLUSION
Rapport building and finding the goals and motivations of the basketball athletes are the best ways to gain insight into how nutrition can help them. Relating nutrition and their on-court performance can help basketball athletes see how they can benefit from making thoughtful nutritional decisions. Through a combination of education and communication with players, athletic trainers, and coaches, and having a strong nutrition presence, teams are more likely to buy in and become consistent with basketball nutrition strategies.

REFERENCES


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**ABOUT THE AUTHOR**

Amanda Poppleton joined the North Carolina State University Athletics Department staff in July of 2014. Her current title is the Assistant Director of Sports Nutrition, where she oversees the nutritional needs of the men’s basketball, baseball, softball, men’s soccer, women’s soccer, swimming/diving, cross-country, track, volleyball, gymnastics, and rifle teams. She focuses the most on the men’s basketball team, as she manages their day-to-day nutrition, including at home and on the road. Additionally, she has also held the Sports Nutrition Assistant position at both the University of Georgia and the University of Florida. Poppleton received her Bachelor of Science degree (MFN) from the University of Tennessee in Knoxville, TN. She earned her Master’s degree in Food and Nutrition from Bowling Green State University. Poppleton was one of 12 nominated invitees to the first annual Collegiate and Professional Sports Dietitians Association (CPSDA) Advanced Practice Workshop for upcoming Sports Registered Dietitians (RD) in 2014.

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**TABLE 1. SAMPLE RANGES OF DAILY CARBOHYDRATE AND PROTEIN NEED FOR BASKETBALL ATHLETES (1,16)**

<table>
<thead>
<tr>
<th>BODYWEIGHT (LB)</th>
<th>BODYWEIGHT (KG)</th>
<th>CARBOHYDRATE (BASED ON 7 – 9 G/KG)</th>
<th>PROTEIN (BASED ON 1.4 – 1.7 G/KG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>81.8</td>
<td>572.6 – 736.2</td>
<td>114.5 – 139.1</td>
</tr>
<tr>
<td>210</td>
<td>95.5</td>
<td>668.5 – 859.5</td>
<td>133.7 – 162.4</td>
</tr>
</tbody>
</table>

**TABLE 2. BODY FAT PERCENTAGE FINDINGS IN BASKETBALL ATHLETES (16)**

<table>
<thead>
<tr>
<th>POSITION</th>
<th>GUARDS</th>
<th>FORWARDS</th>
<th>CENTERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Athletes</td>
<td>6 – 11%</td>
<td>10 – 13%</td>
<td>11 – 14%</td>
</tr>
<tr>
<td>Female Athletes</td>
<td>14 – 17%</td>
<td>-</td>
<td>18 – 20%</td>
</tr>
</tbody>
</table>
There are several different screening tests and exercises that may help identify underlying issues that can lead to common injuries seen in National Collegiate Athletic Association (NCAA) Division I basketball players. This article will focus on the common injuries seen in basketball players, effective screening protocols, prevention exercises, and training methods that can be used to identify potential risk factors associated with injuries and potentially prevent these common injuries from occurring in Division I basketball players.

INJURIES
Basketball, like most sports, has become a year-round sport in the United States. As a result, by the time these athletes get to the college level, many of them are already suffering from musculoskeletal imbalances. This may be, in part, due to an overspecialization in their sport without proper strength, conditioning, flexibility, mobility, and soft tissue training programs in place to help prevent or correct these imbalances. Research has shown that the majority of injuries in college basketball for both men and women are lower extremity injuries (1,5). Of these injuries, some of the most common ones include patellar tendinopathy, inversion ankle sprains, and anterior cruciate ligament (ACL) tears.

PATELLAR TENDINOPATHY
Patellar tendinopathy, or ‘jumper’s knee, is one of the most common injuries in both male and female collegiate basketball players. Patellar tendinopathy is a chronic overuse injury that usually comes with anterior knee pain along the patellar tendon. It can be acute or chronic and may lead to a decrease in performance. Research has suggested that, amongst other factors, decreased range of motion (ROM) in ankle dorsiflexion, tight quadriceps and hip flexors, inadequate lower body strength, and poor landing mechanics may lead to an athlete developing patellar tendinopathy (2,10).

INVERSION ANKLE SPRAIN
An inversion ankle sprain occurs when the foot rolls inward underneath the ankle or leg. While the evaluation and rehabilitation of an inversion ankle sprain is not within the strength and conditioning coach’s scope of practice, there are ways for the strength and conditioning coach to help the athlete make a successful return. Research has found a correlation between chronic ankle sprains and hip abduction weakness on the involved limb following an acute inversion ankle sprain (6). This finding suggests that the strength and conditioning coach may want to improve hip abduction strength to prevent inversion ankle sprains.

ANTERIOR CRUCIATE LIGAMENT TEAR
The ACL is located in the middle of the knee joint and its main purpose is to limit the amount of forward translation of the tibia relative to the femur. An ACL tear can occur in a number of ways, including non-contact hyperextension when decelerating, landing, or changing direction. Studies have shown that properly balanced strength ratios (particularly between the quadriceps and hamstrings) and the introduction of neuromuscular and proprioceptive exercises into a strength and conditioning program can help to prevent ACL tears (3,9).
SCREENING
Overhead Squat Test (Figures 1 and 2)
The overhead squat test assesses range of mobility, symmetry, and function at the ankles, knees, hips, pelvis, and thoracic spine. The test begins with the athlete standing barefoot, with their feet shoulder-width apart, toes straight ahead, and a dowel rod placed on their head with the elbows bent at a 90-degree angle. The athlete then locks their elbows out and squats as low as they can in a controlled motion. If they are unable to squat below the point where their thighs are parallel with the floor, then they can elevate the heels to allow for greater ankle ROM. Where an athlete’s overhead squat movement breaks down can be revealing about what type of musculoskeletal imbalances they have and what injuries they may be at an increased risk for getting. Many basketball players struggle with this test due to limited ankle dorsiflexion, limited thoracic spine extension, and tight hip flexors (4).

Thomas Test (Figures 3 – 5)
The Thomas test is used to test tightness in the hip flexors and differentiate hip flexor tightness between the iliopsoas and rectus femoris. Many basketball players have tight hip flexors and this test helps to identify if tightness exists in both muscles or if it is localized to one muscle, as well as helps determine disparities between the limbs (7). This test begins with the athlete on a training table or bench with both legs tucked up towards the chest. The athlete releases one leg at time letting the hip fully extend while holding the opposite leg in place near the chest. Downward pressure can also be added to the extended leg to help determine tightness and flexibility.
Drop Landing Test (Figures 6 – 8)
The drop landing test is useful for looking at an athlete’s landing mechanics and any injuries they may be at risk of developing based on their landing mechanics. The test begins with the athlete standing on top of a box (a 24-in. box is recommended for most athletes). The athlete is instructed to step off the box and land softly with both of their feet hitting the floor at the same time. A useful coaching cue is to instruct the athletes to transfer their weight from “ball to the heel” and “push the hips back” as they land. They should also avoid letting their knees come together.
Active Straight-Leg Raise Test (Figures 9 and 10)
The active straight-leg raise test assesses active hamstring flexibility while maintaining a stable pelvis. The test begins with the athlete lying supine on the floor with their toes pointed up. Slowly and under control, the athlete will lift one leg up as high as possible with the active leg straight, while the opposite leg and low back remain flat on the floor. If the athlete’s active leg does not stay straight or if it cannot reach a point where it is perpendicular to the floor, then there could be hamstring or plantar flexor tightness. If the opposite limb lifts off the floor, or the pelvis moves into an anterior tilt, then the hip flexors on that limb are most likely tight (4).

Single-Leg Hop for Distance
The single-leg hop for distance test is used to assess symmetry in strength and power between lower limbs. It is commonly used following ACL reconstructive surgery to evaluate the rehabilitation process by providing an objective measure for return to play. To perform the test, the athlete stands on one leg and jumps as far as they can, but they must land properly. Three attempts are given and the average of the three attempts is the final score. If there is a difference of more than 10% between limbs, then there is likely a disparity between the limbs, making the athlete more susceptible to injury (8).

Triple Single-Leg Hop for Distance
The triple single-leg hop for distance test is also used for assessing functional symmetry in strength and power between lower limbs. The athlete performs three successive hops on one leg and must land correctly in order for the score to count. The grading criteria is the same as the single-leg hop for distance test, with a 10% difference between the limbs being the cutoff (8).

PREVENTION
After gathering information regarding an athlete’s injury history and completing the appropriate screening, strength and conditioning coaches can develop an exercise program to help prevent the likelihood of an injury. The following are stretches and exercises that can be used to help prevent the injuries mentioned earlier and to help correct the imbalances discovered during the tests and screens if implemented into a training program appropriately.
STRETCHES
Bulgarian Hip Flexor Stretch (Figures 11 and 12)
This stretch has two techniques and targets both the rectus femoris and iliopsoas. To stretch the rectus femoris, the athlete places one foot on a bench behind them with the top of the foot facing down. The athlete takes a step out and puts the rear knee down on the floor (or padded surface). Next, the athlete pushes their buttocks onto the rear foot and lifts their arms over their head.

To target the iliopsoas with the Bulgarian hip flexor stretch, the athlete takes an exaggerated step out after putting the rear foot on the bench with the top of the foot facing down. Then, the athlete holds a split squat without letting the knee touch the floor to best of their ability. The arms are also placed over the head.

Wall Ankle Rocks (Figures 13 and 14)
This stretch primarily targets the Achilles tendon and soleus muscle. It begins with the foot elevated on a slant (a tri-stretch device or small weight plate may work) so that the toes are elevated above the heel. While keeping the heel flat on the slant or plate, the athlete rocks the knee forward medially over the big toe and laterally over the little toe. The athlete can use a wall for balance and support. Each rock is held for one second before returning to the starting position. Perform one set of 10 repetitions in each direction for each foot.
Two-Part Lunge (Figures 15 and 16)
The athlete begins by stepping into a forward lunge and attempting to reach the ipsilateral elbow to the floor while keeping the back leg as straight as possible. After holding for one second, the athlete places both hands on the ground and straightens the front leg out. After holding for one second, the athlete steps forward with the opposite leg and repeats the same movement for the desired number of repetitions.

RESISTANCE EXERCISES
Pistol Squat on Bench (Figures 17 and 18)
The exercise begins with the athlete standing on one leg. Slowly and under control, the athlete sits back while maintaining the alignment with the knee and toes until they reach the bench. The athlete pauses for a second on the bench and then stands back up using the same leg, returning to the starting position. This exercise helps teach the athlete to track the knee over the toes without letting the knee move anteriorly over the toes. It works the quadriceps and gluteals of the working leg. This exercise can be used in all phases of the off-season and in-season as a warm-up/activation or in the exercise routine itself.
Dumbbell Single-Leg Romanian Deadlift (Figures 19 and 20)
The athlete begins by standing on one leg with the opposite knee slightly bent and in the air behind the body. Slowly and under control, the athlete flexes the hips keeping the hips square and the dumbbells close to the thighs. The athlete pauses at the bottom position with their back flat and parallel to the floor with the opposite leg flat and parallel to the floor as well. The athlete returns to the starting position while maintaining a rigid torso. This exercise is great for athletes with weak hamstrings, spinal erectors, and gluteus maximus muscles. This exercise can be used in the preparation and endurance phases of the off-season or in the in-season.

Trap Bar Deadlift (Figures 21 and 22)
This exercise begins with the athlete standing with their feet shoulder-width apart inside the trap bar. To get into the starting position, the athlete pushes their arms and hips back like they are going to perform a vertical jump, grabbing the bar at the bottom of the motion. From there, the athlete pushes the shoulder blades together and puts the spine in a neutral position. When looking at the start position from a lateral viewpoint, the shins should be near vertical, the hips should be higher than the knees, the torso should be rigid, and the spine should be neutral. Slowly and under control, the athlete drives through the heels with the hips and torso rising at the same time. The athlete finishes by extending the hips and knees fully to come to an erect, or standing, position. The athlete then lowers the bar under control to the floor. This exercise is great for developing the hamstrings, glutes, and erectors while placing minimal stress on the knee joints. The trap bar deadlift can be used in all phases of the off-season and in-season.
Dumbbell Bulgarian Split Squat (Rear Foot Elevated Split Squat) (Figures 23 and 24)
The exercise begins with the athlete’s rear foot on top of a bench behind their body. The athlete then takes a step out with the lead foot away from the bench. With the weight on the front heel, the athlete lowers their body under control until the front thigh is parallel to the floor. The athlete then drives through the front heel and returns to the starting position. This exercise can be loaded in a variety of ways, not just dumbbells, and can be used in all phases of the off-season and in-season.

Buddy Hamstrings (Nordic Curls) (Figures 25 and 26)
This exercise begins with one athlete kneeling on a pad and a partner holding his ankles. With the torso and hips in a neutral and erect position, the athlete slowly falls to the floor maintaining the rigid posture with their hands out ready to absorb the impact of falling. When the athlete’s hands touch the floor, they immediately push back to the starting position with as little upper body force as possible, relying on the hamstrings to pull the torso back up. It is important that the rigid posture is maintained throughout the exercise to avoid injury and emphasize the hamstrings. This exercise is great for developing eccentric hamstring strength and can be used in all phases of the off-season and in-season.
EXERCISE PROGRESSION

Progressing from the drop landing to a depth jump to a depth jump to box exercise can help to teach the proper biomechanics when landing and jumping, as well as helping with the rate of force development. Depending on the athlete’s mechanics, strength, and power, it is advised to spend about 4 – 6 exposures in each progression before moving on to the next but appropriate progression will vary between athletes.

Drop Landing

Much like the drop landing test, the athlete starts on top of a box (18 – 24 in.) and steps off the box, landing as softly as possible. The feet should land simultaneously, with the weight being transferred from the balls of the feet to the heels, while pushing the hips back to absorb the impact rather than letting the knees move anteriorly. It is important that the athlete lands with the hips higher than the knees as gradually bending the knees will teach the athlete to dissipate the force. The athlete holds this landing for a two-count before standing and returning to the box for the next repetition. It is important that the knees track in line with the toes and do not collapse inward.

Depth Jump

After demonstrating proficiency in the drop landing, the next progression is the depth jump. Like the drop landing, the athlete starts on top of a box and steps off, landing as softly as possible. Immediately after contact is made with the floor, the athlete then jumps vertically as quickly as possible, minimizing the contact time with the ground. It is important to note that while emphasis is placed on minimizing ground contact time, the jump should not be so fast that they do not land properly or cannot apply enough force into the ground to jump vertically. After jumping vertically, the athlete should land the second time in the proper landing position with the weight being transferred from the balls of the feet to the heels and pushing the hips back to absorb the impact. The athlete holds for a two-count before standing and returning to the box for the next repetition.

Depth Jump to Box (Figures 27 – 29)

After demonstrating proficiency in the depth jump, the next progression is the depth jump to box. Like the depth jump, the athlete starts on top of a box and steps off, landing as softly as possible. Immediately after contact is made with the floor the athlete then jumps onto a second box as quickly as possible. Minimizing ground contact time is still a point of emphasis in addition to the landing mechanics on the second box. The athlete should land with the same mechanics as in the first two progressions; this exercise can lose its efficacy when the second box is so high that proper landing mechanics can no longer be achieved.
CONCLUSION
Basketball is a physically demanding sport that requires physical preparation to be successful at the highest level. Strength and conditioning coaches should investigate methods to identify potential risk factors associated with injury. From properly gathering this information, strength and conditioning coaches can create individualized strength and conditioning programs to help keep their athletes healthy and performing at the best of their abilities.

REFERENCES

ABOUT THE AUTHOR
Casey Cathrall is the Director of Basketball Strength and Conditioning at Louisiana Tech University in Ruston, LA. Previously, he served as the Director of Strength and Conditioning at the University of Maryland, Baltimore County. Cathrall has additional strength and conditioning experience at the University of Miami, Florida International University, and the Performance Center at the National Strength and Conditioning Association (NSCA) World Headquarters in Colorado Springs, CO. He received his Bachelor of Science degree in Clinical Health Studies from Ithaca College and his Master of Science in Education degree in Exercise Physiology: Strength and Conditioning from the University of Miami. He is a Certified Strength and Conditioning Specialist® (CSCS®) and Member of the National Strength and Conditioning Association (NSCA).
When creating a strength and conditioning program for athletes of any age, a needs analysis is essential to identify the needs and limitations of the athlete for a particular sport (1). A needs analysis includes all fitness and performance attributes specific to the sport as well as the psychosocial elements of sport (4). For youth athletes, the focus of strength and conditioning should be on multilateral development, training-age related exercises and drills, and injury prevention through the application of safe and proper technique, rather than the amount of weight lifted (2,4,7). A needs analysis for basketball reveals that the phosphagen and glycolytic systems are the most dominant, but aerobic metabolism is also involved. Locomotor skills commonly seen in basketball include running, jogging, and submaximal repeated jumping (multiple-effort power) in combination with body awareness skills such as turning, landing, dodging, static and dynamic balance, and agility. Another aspect of the sport involves object control skills for controlling a basketball while dribbling, passing, shooting, rebounding, etc.

To satisfy the needs of strength and conditioning for youth basketball, a multidimensional, comprehensive youth-focused program is recommended. Integrative neuromuscular training (INT) has been shown to be an effective training methodology to improve fitness, promote physical activity, and engage youth in the strength and conditioning process (8). INT includes health fitness (e.g., muscle strength, cardiovascular endurance, muscle endurance, and flexibility), skills fitness (e.g., agility, balance, coordination, speed, power, and reactive ability), and sports fitness (e.g., applied motor skills in a sports context) in a balanced age-related progression. INT has been shown to promote physical literacy and long-term athletic development (5).

**SAMPLE INT EXERCISES FOR YOUTH BASKETBALL**

It is important to remember that the training age of young athletes needs to be considered when designing the INT program. Each participant should have an individualized program based on their experience with strength and conditioning, not on their age or grade in school. Youth strength and conditioning coaches who work with youth basketball athletes are encouraged to select exercises and drills that are appropriate for their athletes. Table 1 provides several exercises and drills that may be integrated into a youth basketball athlete’s INT program.

**CONCLUSION**

Basketball involves health, skills, and sport fitness attributes. INT incorporates, and improves, these attributes and is effective for reducing the risk of injury (5,8). Strength and conditioning coaches with knowledge of the exercise principles for youth and the specific demands of basketball can design effective INT programs based on the individual needs of youth athletes.
TABLE 1. SAMPLE INT BASKETBALL EXERCISES

<table>
<thead>
<tr>
<th>EXERCISE</th>
<th>BASKETBALL APPLICABILITY</th>
<th>REASON FOR INCLUSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kettlebell swing</td>
<td>Power</td>
<td>Reinforces athletic stance, hip mobility, and kinetic chain connectivity</td>
</tr>
<tr>
<td>Medicine ball partner pass</td>
<td>Passing</td>
<td>Involves upper body push work with release</td>
</tr>
<tr>
<td>Standing broad jump</td>
<td>Lower body strength and power</td>
<td>Correlates with other lower body strength measures and upper body strength measures (3)</td>
</tr>
<tr>
<td>Russian Kettlebell Challenge (RKC) plank</td>
<td>Trunk stability</td>
<td>Focuses on stability of all body segments</td>
</tr>
<tr>
<td>Goblet squat six-inch box jump complex</td>
<td>Lower body strength and power and proper landing mechanics</td>
<td>This type of complex training can improve jumping ability in youth basketball players (9)</td>
</tr>
<tr>
<td>Band rows</td>
<td>Strength</td>
<td>Promotes upper body muscular balance</td>
</tr>
<tr>
<td>Standing cable wood chop</td>
<td>Rotational strength and mobility</td>
<td>Works on trunk rotation</td>
</tr>
<tr>
<td>Unilateral balance drill</td>
<td>Balance</td>
<td>Improves balance, which predicts ankle sprain in youth basketball (6)</td>
</tr>
</tbody>
</table>

REFERENCES


ABOUT THE AUTHOR

Rick Howard helped start the National Strength and Conditioning Association (NSCA) Youth Special Interest Group (SIG) and served this year as Immediate Past Chair. In addition, Howard serves on the NSCA Membership Committee and is the NSCA State/Provincial Program Regional Coordinator for the Mid-Atlantic Region. Howard is involved in many pursuits that advance knowledge, skills, and coaching education to help all children enjoy lifelong physical activity and sports participation.
HOW TO DEVELOP POWER—A LOOK INTO THE PREPARATION OF A 2015 NBA 2ND ROUND DRAFT PICK

ERIK KALOYANIDES, CSCS

NEED

After the completion of a grueling season, one that included an Elite 8 appearance in the National Collegiate Athletic Association (NCAA) Division I national basketball tournament and an invite to another post-season tournament, a college basketball player came to me with roughly five weeks of time to train prior to the National Basketball Association (NBA) Combine. The NBA Combine is a multi-day event where amateur basketball players are subjected to physical measurements, basketball skill drills, medical evaluation, and specific tests in an effort for team executives and scouts to determine each player’s potential for being successful in the NBA.

Below is the list of tests that are featured at the NBA Combine (1):

- Standing Vertical Jump
- Max Vertical Jump
- Lane Agility
- Three Quarter Court Sprint
- Shuttle Run
- 185 lb Bench Press for Maximum Repetitions

After meeting with this athlete, we determined that his goal for the NBA Combine was to show the scouts that he was athletic enough to play in the NBA. This goal translated into showing he had the ability to create his own shot, cover a very athletic shooting guard, and get his shot off. Knowing the athlete’s baseline tests and the requirements of the Combine, we decided that his training needed to focus on improving his overall explosiveness. We designed a five days per week, five-week program with the major goal of improving power. The following is the training program used to prepare this athlete for the NBA Combine.

PROGRAM DESIGN PHILOSOPHY

Researchers have shown that resistance training can improve strength, which can translate to more explosiveness for basketball players (7,8,9). Therefore, based on the needs of this athlete, we decided to break down the training to five days per week. Two days per week would primarily focus on explosive movements with single-leg strength as the secondary focus, two days per week would focus on explosive movements where we would isolate the hips without jumping and focus on lower body strength development using both legs, and the other day would focus on recovery and mobility.

Due to the time it would take to teach weightlifting lifts (Olympic-style), and the lifting experience of this athlete, we decided he would not perform any clean or snatch variations during this program. This is not intended to devalue weightlifting or prescribe against the use of those lifts in general. The limited time before the Combine (5 weeks) and inexperience with those lifts while in college determined that the learning curve was going to be
too much to overcome in too short of a period for this athlete. In other words, the risks of incorporating Olympic-style lifts in such a short time did not outweigh the potential rewards, so we instead focused on other exercises through this 5-week program.

**WARM-UP**

Dynamic warm-ups have been shown to improve flexibility and improve jumping performance (5,6). Based on this athlete’s needs, the dynamic warm-up emphasized glute activation and hip flexor engagement exercises. The glute activation segment of the dynamic warm-up included the following exercises:

- Mini Band Monster Walks (15 yards each direction)
- Speed Band Knee Outs (1 x 15)
- Double-Leg Hip Thrusts (1 x 15)
- Single-Leg Hip Thrust Holds (60 s hold)
- Fire Hydrants (1 x 15)
- Clams (1 x 10 per side)
- Toe Down Lateral Leg Raises (1 x 10 per side)

We conducted the above dynamic warm-up, inclusive of glute activation, each day. Based on the time constraints, there was not much opportunity or need to progress this athlete’s warm-up regimen.

**TRAINING**

During the explosive training days, this athlete would spend the majority of time doing work on an accommodating variable pulley training system, which features a platform and multiple pulleys with band attachments to vary resistance. Using the arm bands helped develop arm swing velocity, which can enhance an athlete’s vertical jump performance (10,11). A benefit of an accommodating variable pulley training system is that it can simultaneously train explosive leg power and arm swing velocity by loading both the legs and arms while jump training. This feature allows athletes to train multiple factors of vertical jump performance (3). The program for this athlete is described below.

**DAY 1**

**Set 1**

- Double-Leg Vertical Jump with Red Bands
  - 4 reps with a brief pause followed by 4 continuous reps
- Single-Leg Vertical Jump with Red Bands
  - 3 reps on each leg with a brief pause
  - Followed by a set of 2 bodyweight contrast double-leg jumps

Researchers have shown that jumping ability can be improved through loaded plyometric exercises (4). Therefore, the athlete next performed plyometric exercises. We used the Dumbbell (DB) Vertical Jump to activate the hips with an external load. Without the use of an arm swing to assist in power development, this exercise is well suited to train the hips to move as fast as possible. In this program, the athlete would do 2 sets of 6 reps while holding 20-lb DBs, and then finish with a contrast set of two bodyweight vertical jumps incorporating the arms into the jumps. A contrast set is a set of high/heavy resistance lifts/exercises, followed immediately by performance of an explosive exercise using the same movement pattern.

Following the plyometric exercises, the athlete used a pneumatic squat machine for explosive squats (this machine is a pneumatic apparatus that measures power during a squat or similar movement). This machine provides information on the power output for every rep, which gives real time data as to the quality of each rep. This athlete would do 6 sets of 3 reps while holding 20-lb DBs, and then finish with a contrast set of two bodyweight vertical jumps incorporating the arms into the jumps. The explosive portion of day 1 was complete after the squats. The athlete then performed a variety of single-leg strength exercises (e.g., single-leg squats, rear foot elevated split squats, lunges, step-ups) paired with a hamstring-specific exercise (e.g., seated single-leg resistance band leg curls, single-leg hip thrusts, glute ham raises, hamstring slideboard leg curls). We designed the program to achieve muscle balance between the quadriceps and hip flexors and the hamstrings and gluteal muscles.
DAY 2
The second day of this program started with kettlebell swings to activate the hips to help develop explosive strength. Kettlebell swings have been shown to improve maximal and explosive strength (2). Kettlebell swings are also an effective method to train explosiveness while limiting stress on the joints from repeated jumping. This was especially important for this athlete throughout the 5-week period because he was spending numerous hours on the court working on his basketball skills, which involved a lot of jumping.

The second day also focused on strength exercises. We progressed this athlete to deadlifts after the kettlebell swings. The deadlift was an effective exercise to strengthen the muscles of the hips and knees. To perform the deadlift, the athlete’s hips and the legs (more specifically, the muscles that extend the knees and the hips) generate force to overcome the load. The deadlift is an effective exercise at activating the muscles of the legs, hips, back, and arms, which are all strengthened with progressive loads. Although some coaches use special or isolated exercises to train these multiple muscle groups, the deadlift is particularly useful because of the multiple muscle groups involved.

DAY 3
This day of training focused primarily on active recovery, mobility, and flexibility. Rest and recovery are vital to making sure each training day is maximized to its fullest. It was important to provide an opportunity for active recovery knowing that this athlete had on-court sessions after each one of these workouts. Recovery was dictated by several factors, including the athlete’s self-perceptions each day and the training schedule.

DAY 4
The fourth day started with a concentration on single-leg strength and explosive work. The pneumatic squat machine was used for explosive single-leg squats, but with a much lighter resistance than on Day 1. For the single-leg squats, he performed three reps per set for each leg, with a brief pause in between each rep. The resistance increased progressively through the five weeks.

DAY 5
The fifth day began with a focus on isolating the hip flexor and training it dynamically. The athlete would perform explosive knee-ups while attached to the accommodating variable pulley training system, which ensured the isolation of the hip flexor and trained it to activate as fast as possible.

This training day was also a squat day, so this athlete performed squats in the pneumatic squat machine. The program utilized pause squats, in which the athlete squatted down to parallel, paused for a one count, and then exploded up to full extension of the hips and knees. This type of squat was selected rather than the barbell squat because it can potentially lead to jumping improvement while allowing the athlete to concentrate fully on hip speed without having to worry about losing control or posture.

There was still a focus on power output, but it was treated as more of a strength exercise where with the resistance much higher.

SUMMARY
As one can see, the two main strength exercises of this 5-week program were deadlifts and squats. All other strength exercises were single-leg variations. Every basketball player has a dominant leg and it was a goal of this program to get the non-dominant leg developed as equally as the dominant leg. By doing this, the program effectively made the athlete a better double-leg jumper while limiting the potential for injury. Two days per week were spent doing exercises in which the athlete was jumping, one day concentrated on extension while limiting the number of ground contacts from the use of kettlebell swings, and the other day isolated the hip flexor, which limited the number of ground contacts.

Since five weeks is not a lot of time to prepare for such an important event, the need to maximize every minute of training was vital. It was also important to understand how much time the player was spending on the court working on basketball skills during preparation in order to maximize gains and avoid overtraining.

Finding the appropriate balance between plyometrics, strength, and explosive work where the hips could be activated without jumping was a challenge. In the end, this athlete increased his max vertical jump by seven inches, recorded a 2015 NBA Combine best 44-in. max vertical jump, and was selected in the 2nd round of the NBA Draft.

REFERENCES


**ABOUT THE AUTHOR**

Erik Kaloyanides is considered one of the nation’s leading experts in athletic performance and strength and conditioning. In 2015 alone, he was responsible for training 10 players who signed National Football League (NFL) contracts, a 2nd round National Basketball Association (NBA) draft pick, and a 1st round Major League Baseball (MLB) draft pick. Kaloyanides focuses his training on developing explosiveness and speed. He is the President and Founder of Athletic Evolution CrossFit, EK Performance, and 5 Star Academies. Kaloyanides is certified by the National Strength and Conditioning Association (NSCA) as a Certified Strength and Conditioning Specialist® (CSCS®). He also has his CrossFit Level I certification and is a Nike Trainer. Kaloyanides is a former scholarship football player for Syracuse University, where he holds degrees in finance and marketing.
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