DYNAMIC WARM-UPS FOR LAND-BASED ATHLETES

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Some of the most frustrating moments of an athletic or coaching career is when injury occurs. Cutting, pivoting, pushing, twisting and falling can influence the susceptibility of muscle to injury. No matter the severity level, an injury can limit a player's ability to perform. Over 1.35 million children ages 19 and under were seen in emergency departments for injuries related to commonly played sports in 2012 alone (9). One way to potentially lower an athlete's susceptibility to injury is a proper warm-up protocol. Warm-ups can potentially aid in injury prevention, as a result of optimized movement preparation, but also reduce the delay of muscle soreness and improve performance variables (2,3,8,13). Dynamic warm-up techniques best mimic the movement patterns of sport, making it a suitable choice for properly acclimating the athlete for play (2,4,5,7,8,10,11,13).

PURPOSE OF WARM-UP

When properly performed, warm-ups will elicit a physiological response that includes increased core temperature, heart rate, and blood flow with a decrease in viscosity of joint fluids (2,5,7,8). When muscles begin to work harder than at rest, the temperature of the muscle will rise, allowing more pliability and an increased range of motion throughout a joint. These improved muscle dynamics reduce the injury potential (13). A warm-up also serves to ready the body for the imposed demands of sport. When a coach is designing a pre-activity routine for sport; increasing flexibility of the muscles around each joint can be addressed utilizing various stretching techniques such as ballistic, proprioceptive neuromuscular facilitation (PNF), static, and dynamic methods. Ballistic, PNF, and static stretching may alter motor unit activation and ultimately influence performance negatively (1). The focus of this article will be on static and dynamic warm-up methods as well as their ability to be performed safely and easily implemented.

STATIC VERSUS DYNAMIC STRETCHING

Traditional flexibility training in the form of static stretching has often been utilized prior to practice or competition. Static stretches are those in which an individual will move slowly to an end position, then hold for an extended period (8). Including brief static stretching (less than 90 s) can be beneficial for sports that require a greater range of motion, such as hockey, wrestling, or gymnastics (2,10). Static stretching may cause a decrease in performance, such as muscle strength and power production, if done immediately prior to the event (2,3,4,6). Static stretching prior to an event lengthens the muscles, resulting in a decreased ability for motor unit activation and crossbridge overlap, which can lead to lower muscle force output (1,2). This deficit has been shown to be a 7 – 8% reduction from maximal voluntary contraction and may last up to two hours (2,12). In addition, blood flow to the muscle can be affected, leading to a decrease in performance (2). Therefore, intense and extended static stretching prior to athletic movement should be contraindicated (2,5,12). A coach should be cognizant of these potential deleterious effects, particularly when explosive movement or maximal strength is necessary. Static stretching can be programmed into a training regimen most efficiently post-session (2). This technique has

shown positive correlation towards increasing range of motion. This results in more permanent change to flexibility (2).

Dynamic stretching techniques differ by allowing the individual to move throughout a range of motion required for sport (8). The exercises associated with dynamic stretching should mimic those movement patterns typically seen during competition (8). The physiological effects of the dynamic warm-up include: faster muscle contraction and relaxation of agonist and antagonist muscles, increased rate of force development, increase in muscle strength and power, lowered viscous resistance in muscles, improved oxygen delivery, increased blood flow to active muscles, and enhanced metabolic reactions (5,8,11,13). An athlete that follows a dynamic warm-up will see increased performance as they are aptly prepared for sport. Dynamic warm-ups have yielded results of an increase of 5.3% in long jump and 5.4% increase in vertical jump performance (11). With proper implementation of dynamic warm-ups, the athletes should experience the previously noted effects for the duration of their activity (2,5,8,11,13).

WARM-UP PROGRAM DESIGN AND IMPLEMENTATION

The length of the programmed warm-up can vary based upon the sport, individual, and environment (8). The first 5 – 10 min should be in the form of general movement preparation to raise the core body temperature. The general movement should include walking, jogging, arm swings, or arm circles. Designing a routine for the land-based athlete should include a review of the major muscle groups needed to perform the required movement patterns. For sports that involve running, jumping, cutting, and pivoting, an emphasis should be placed on muscles with actions in the hips, knees, and ankles. Activation of these muscles (quadriceps, hamstrings, glutes, and calves) can be established by utilizing movements such as: walking knee pulls, walking quad stretch, and proceeding into a lunge. Incorporating upper body muscles and core musculature should also be considered when designing a warm-up, as sport requires multiple segments of the body working in unison to achieve action. A way to stimulate full body movement is to perform a lunge with rotation or inchworm with push-up. As the athletes perform each movement, helpful coaching cues include to feel/focus on the muscles stretching and envision the carryover to sport. When beginning the warm-up, the athlete should start out slowly before being elevated to an increased intensity level. Table 1 utilizes an ideal warm-up progression, increasing from a single joint movement to full-body involvement. Following the generalized routine there should be a shift towards sports specific movements in which the athlete is competing (see Table 2). A sports specific warm-up period lasts 8 – 12 min and utilizes similar movement patterns to provide direct translation into the athlete's sport (in the case of Table 2, football) (8). This will manifest as a beneficial addition to their pre-competition warm-up. An important consideration is to prepare the athlete, not to exhaust them. Inducing fatigue prior to competition can lead to a decrease in performance, and even an increased risk for injury (2,13).

As with all athletes, skill level, ability, and age will affect parameters of the dynamic warm-up. For a more advanced athlete, adding the use of medicine balls, resistance bands, weighted vests, and ankle weights can be used to progress the difficulty. The usage of these resistance methods can increase explosive power due to increased neuromuscular function, also known as post-activation potentiation (PAP) (5). Coaches should limit the resistance to 6 – 10% of bodyweight to achieve PAP and prevent pre-exhaustion (5). Exercises can also be done in different planes to enhance ability to change direction. A standard lunge is performed in the frontal plane, but can be performed laterally in the transverse plane by adding a left to right rotation. Additionally, a traditional bear crawl within the frontal plane can be modified to the sagittal plane by moving laterally.

CONCLUSION

Preparation for sport can be the difference between healthy or injury prone athletes, and that can directly affect the outcome of competition. The coach must be aware of their athletes' skill levels and not pre-exhaust the athletes prior to competition. This requires finding balance between the length and the intensity of the warm-up. The sample program within the tables provides an appropriate progression starting at low intensity before increasing the muscle involvement and movement complexity. The successful implementation of the dynamic warm-up will leave athletes ready for the rigors of sport.

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TABLE 1. SAMPLE GENERALIZED DYNAMIC WARM-UP PROGRAM

EXERCISE	DISTANCE
2 - 3 min light jog	-
Arm circles	30 s
Crossbody arm swings	30 s
Walking knee pull	15 yards up and back
Figure 4	15 yards up and back
Walking quad	15 yards up and back
Punter's walk	15 yards up and back
Lunge with rotation	15 yards up and back
Inchworm with push-up	5 yards up and back
Bear crawl	15 yards up and back

TABLE 2. SAMPLE OF A FOOTBALL-SPECIFIC WARM-UP PROGRAM

EXERCISE	DISTANCE
High knees	15 yards up and back
Back pedal	15 yards up and back
Side shuffle	15 yards up and back
Carioca	15 yards up and back
Power skips	15 yards up and back
50% max intensity run	40 yards
75% max intensity run	40 yards

FIGURE 1. FIGURE 4 – START

FIGURE 2. FIGURE 4 – END

FIGURE 3. WALKING QUAD – START

FIGURE 4. WALKING QUAD – END

FIGURE 5. PUNTER'S WALK

FIGURE 6. INCHWORM – START

FIGURE 7. INCHWORM WITH PUSH-UP AT BOTTOM POSITION

FIGURE 8. INCHWORM – END

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