Heat Up your Warm Up with Plyometrics

by Joe Giandonato, MS, CSCS

For decades, plyometrics have served as a mainstay in athletic preparation. Their creation dates back to the 1950's, when renowned Russian Sports Scientist, Dr. Yuri Verkhoshansky began implementing depth jumps with his track athletes. Verkhoshansky used the jumps to in an attempt to replicate the biomechanical demands of the takeoff in triple jump in training. He reasoned that his athletes would have to use enormously heavy loads on barbell squats to duplicate the takeoff.

The depth jump was performed from an elevated surface, whereby an athlete would drop from and jump immediately after they landed on the ground. Verkhoshansky's rationale behind depth jumps was the body absorbing forces from the landing and quickly redirecting them into the ground during the subsequent jump.

Verkhoshansky's discovery of this new form of training, initially termed "Shock Training", soon infiltrated the sports training community, forever influencing the design of strength and conditioning programs.

Coaches and athletes grew enamored by Shock Training and began incorporating it within their programs, grossly underestimating the demands that depth jumps imposed on the body. As we'll soon learn, when it relates to plyometric training, "more" certainly does not equate to "better". Coaches and athletes should consider plyometric exercises as powerful training tools which must be strategically inserted into strength and conditioning programs to yield optimal benefits. On that note, plyometric exercises have no business appearing

on someone's "WOD" and should never serve as substitutes for traditional compound exercises.

The Science Behind Plyometrics

Coaches and athletes may already be familiar with the physiological happenings behind plyometrics, for those in need of a refresher, here are some key points:

1. Plyometric exercises involve the stretch shortening cycle, or SSC.
2. The SSC is composed of a rapid eccentric muscle action, which stretches the elastic structures of muscles and tendons. This eccentric muscle action is immediately followed by a quick and powerful concentric muscle action.
3. Sensory organs lining the muscles transitioning from an eccentric action to a concentric action relay kinesthetic information such as muscular tension and length to the Central Nervous System (CNS).
4. The concentric muscle action is triggered by the myotatic stretch reflex, a neurophysiologic protective mechanism, which shortens a muscle when it becomes rapidly stretched to prevent injury.

We can conclude from above that the SSC coupled with the resultant concentric muscle action improves force output. The great amounts force output stemming from plyometrics possibly provide the CNS and muscles a potentiating effect which may improve athletic performance.

This theory lends credence to the inclusion of plyometric exercises within warm ups. Let's see if the research has to say about the acute benefits of plyometric exercises.

Plyometrics Enhance Muscle Activation

A recently published study conducted by researchers at the University of Delaware, revealed that single legged hurdle hops performed in the sagittal plane significantly activated the gluteal and hamstring muscles during the preparatory (takeoff) and landing phases of the jumps.

Practical Application: Performing jumping exercises prior to strength training may prove helpful in activating agonist, synergist, and stabilizer muscles involved during the lifts.

Struminger AH, Lewek MD, Goto S, et al. Comparison of gluteal and hamstring activation during five commonly used plyometric exercises. Clin Biomech. 2013. [Epup ahead of print]

Plyometrics Acutely Enhance Jumping Performance

A recently published study involving professional rugby players showed that a series of plyometric jumps performed prior to countermovement jumps improved the height and peak force of the countermovement jumps.

Practical Application: Performing jumps prior to a training session or competition during a warm up may improve performance.

Tobin DP, Delahunt E. The acute effect of a plyometric stimulus on jump performance in professional rugby players. J Strength Cond Res. 2013. [Epup ahead of print]

Plyometrics Preferentially Recruit Fast Twitch Muscle Fibers

A study analyzing the effects of a high volume jumping protocol, involving 10 sets of 10 squat jumps, revealed that fast twitch fibers sustained the greatest amount of damage.

Practical Application: Plyometric exercises involve the rapid activation of fast twitch muscle fibers. Performing a set or two of low rep squat jumps prior to lower body training may help you reactivate fast twitch muscle fibers during squats and deadlifts.

Macaluso F, Isaacs AW, Myburgh KH. Preferential type II muscle fiber damage from plyometric exercise. J Athl Train. 2012;47(4):414-420.

Depth Jumps May Improve Squat Performance

A study involving depth jumps performed prior to assessment of one rep maximum squat strength, noted improvements in performance in the jump groups versus the control group. The group who jumped from 30 cm showed the greatest improvement in squat performance (1). An earlier study also including depth jumps also illustrated their capacity to improve squat performance (2).

Practical Application: Depth jumps performed from lower heights (approximately 30 cm) may improve lower body strength performance.

1. **Brandenburg J, Czajka A. The acute effects of performing drop jumps of different intensities on concentric squat strength. J Sports Med Phys Fitness. 2010;50(3):254-261.**
2. **Masamoto N, Larson R, Gates T, et al. Acute effects of plyometric exercise on maximum squat performance in male athletes. J Strength Cond Res. 2003;17(1):68-71.**

Upper Body Plyometrics Improve Bench Press Performance

A study involving twelve male college athletes revealed that performing two plyometric push ups or two medicine ball chest passes 30 seconds prior to a one rep max bench press attempt improves maximum bench press performance.

Practical Application: Plyometric push ups and explosive medicine ball tosses may be effective in activating the muscles of the chest, deltoids, and triceps. Furthermore, the plyo push ups and med ball tosses could serve as a useful tool in teaching the athlete movement intention. Though the load on the bar may be heavy relative to the lifter, the goal of any one rep maximum exercise is to move the bar with great speed.

> **Wilcox J, Larson R, Brochu KM, et al. Acute explosive-force movements enhance bench-press performance in athletic men. Int J Sports Physiol Perform. 2006;1(3):261-269.**

Based on extrapolations from the research and a number of years in the trenches, I have assembled a list of considerations that you may find helpful if you wish you incorporate plyometric exercises within your warm ups.

Programming Considerations

- Plyometrics performed during the warm up should never be performed with a high volume or to failure.
- Plyometric exercises should be performed immediately prior to the first strength exercise of the day.
- Plyometric exercises used during the warm up should closely mimic the demands of the strength exercise which will be performed next. For instance, broad jumps before deadlifts, squat jumps before squats, and supine med ball tosses or plyometric push ups before bench presses.
- The number of reps should be limited to five or fewer to ensure proper technical execution and to limit neuromuscular fatigue.
- The plyometric exercises can be performed beyond the warm up and concurrent with the first strength exercise, either between sets (contrast training) or prior to maximum attempts.
- For strength athletes, plyometrics should never be performed during deloads
- For other athletes, the volume of plyometric training should be reduced during the course of the season.
- Before plyometrics are included within one’s programming, which includes warm ups, they should be capable of benching at least their own bodyweight, squatting and deadlifting at least 1.5 times their bodyweight.
- Research has indicated that plyometric training enhances tendon stiffness, causing your body to rely on your muscles to absorb and redirect force.

Keep in mind that stiffness equates to more stability and more stability lends itself to greater strength.

- Plyometrics should be reduced or eliminated from the warm ups if athletes are performing them separately in their training.