"Reaction-based training" for the female basketball player

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Opportunities for young female athletes to participate in competitive sports have grown exponentially in this post-Title IX era.

Women's basketball has become increasingly more competitive over the years. With the introduction of the WNBA, our young, female hoopsters now have a league of their own.

Their skills, strength, and conditioning are improving on every level, thanks to superior coaching techniques and the greater commitment to training.

The question that remains is whether the female athletes can respond to the vast improvements in training methodology and introduce "reaction-based training" into the overall conditioning program.

The primary goals of a conditioning program are to enhance the athlete's overall strength, power, speed, agility, and quickness. All of these skills are vital for success in women's basketball, where the specificity of training is essential in program design. The aforementioned skills are all generally addressed in a training program. But just as important is the ability to react.

In general, the athlete's reactive ability, along with her explosiveness and acceleration, make up her overall quickness. Because basketball is a multi-planar sport and quickness is a multi-planar skill, the strength and conditioning programs should devote time to training on all these planes, particularly the frontal plane. That's where lateral movements occur.

Speed and agility training, strength training and plyometrics are all commonly incorporated into the conditioning program to improve the athlete's lateral movement.

These training methods focus primarily on motor skills. There is, however, an inherent component that is directly involved with any movement made by the athlete. We call it the sensory component. It refers simply to the cognitive processing of any stimulus received by the athlete prior to her initiation of movement.

We would suggest the inclusion of yet another dimension, one that would incorporate sensory-motor integration. In other words, one in which an athlete is challenged to respond or react to a stimulus prior to any movement.

In basketball, delayed decision-making (slow reactions) will hinder any maneuver, whether on offense or defense, which may ultimately decide the outcome of the game.

The sensory-motor integration is made up of an intricate series of events. Nerve impulses occur in response to the various stimuli, while muscles contract in response to the nerve impulses.

Reaction time is related to the central nervous system and is a component of this sensory-motor integration.

Reaction time is defined as the interval between a stimulus and the initiation of movement. It does not include the movement itself, only the time immediately prior to it.

In basketball, the athletes react to visual stimuli, auditory stimuli, and physical stimuli. Once a stimulus is initiated, the player will go through three stages of reaction.

[ILLUSTRATION OMITTED]

The first stage consists of the sensory input (the athlete receives the stimulus).

The second stage is the perceptual processing of the stimuli (the time it takes for the athlete to make a decision.)

The third and final stage consists of when the athlete initiates the movement.

The movement time begins when the reaction time ends. It consists of the interval of time between the start of the movement and the completion of it. The reaction time and movement time make up the response time, or the total time between the onset of a stimulus and the completion of the action.

The coordination between the central nervous system and the muscular system is clearly critical. The training to improve this coordination between systems may prove valuable.

The literature is sparse when it comes to the reaction training of the athletes, specifically basketball players. To the authors' knowledge, only one study has been published on the effect of training on the lateral reaction and movement times of intercollegiate female basketball players.

In this study, nine varsity players participated in a daily lateral slide-training program.

After four weeks of training, the players showed an 8.4% improvement in moving to their right and a 4.2% improvement in moving to their left.

After five weeks of using reaction-based performance drills along with an overall preseason-conditioning program, from the Winona State University (MN) women's basketball program indicated a 6.75% improvement in response times.

This may not represent a significant difference, however, as Jenson and Fisher state, "Even small improvements in reaction time may produce significant results in the performance of quick reactions."

The authors further contend that a person's reaction time can be improved by the practice of the particular action, with the emphasis on quickness.

Others have investigated reaction times in general (simple and/or choice reaction time) of athletes and non-athletes alike. Ando, Kida, and Oda *(Showed that the split step was faster than starting from flat foot start)* measured visual reaction time by presenting three different sizes of stimulus to the central and peripheral fields of vision in soccer players versus non-athletes.

The soccer players showed shorter "pre-motor" (the nervous system's processing time) times than the non-athletes, suggesting that the soccer players are able to respond more quickly to a stimulus presented to both peripheral and central positions. Harbin et al. measured response times (reaction time movement time) in three different groups of athletes: high school football and basketball, college football and basketball, and professional football teams.

They found a significant difference between professional and amateur response times ($p=0.0001$). 50% of 180 amateur athletes had a response time that was two standard deviations slower than professional athletes.

The authors concluded that response times might be useful in determining athletic potential. Reaction-based training and/or testing could be another means for assessing the athlete's readiness level for higher competition.

Incorporating reaction-based training into the preseason may be beneficial to the development of the athlete, but it is important for coaches to consider the total year-round conditioning program as well.

Studies have determined that several factors can influence an individual's reaction time. Of most interest for our purposes are the effects of aerobic exercise, the effects of strength training, and the effects of fatigue.

It has been established that reaction time involves both central and peripheral components. So both have to be taken into consideration when establishing any sort of conditioning program that includes reaction-based training.

For example, chronic aerobic conditioning appears to enhance brain function because of its influence on certain neurotransmitters and its positive effect on cerebral blood flow. The speed of cognitive processing is especially sensitive to oxygen levels in particular areas of the brain.

There are generally two schools of thought when it comes to recommending aerobic conditioning for the basketball player. Proponents recommend that aerobic conditioning should become an integral part of the overall conditioning program because of its positive effect on decreasing fat mass, thus enhancing lean body mass.

Opponents argue that aerobic conditioning is not necessary for an anaerobic sport. Research involving older individuals supports a positive effect on reaction times. For example, Rikli and Edwards found that chronic aerobic exercise over a three-year period improved reaction times in older women, while Dustman et al. found that older individuals with four months of aerobic training experienced greater improvements in reaction times than did a non-aerobic exercise group or a non-exercise control group.

One might surmise that the same physiological benefits of aerobic training may occur in younger individuals. In light of the apparent connection between aerobic exercise and improvements in reaction times incorporating aerobic conditioning into the off-season may be warranted. This may further enhance more specific reaction-based training in the preseason.

Muscular strength is also related to reaction time due to its effects on the number of functioning motor units, oxygen delivery within the muscle, and increased peripheral nerve transmission. Furthermore, movement usually involves working against some resistance, even if it means overcoming inertia and simply moving the body. Because of this, contractile force can influence the rate of movement.

Studies support the theory that the stronger the individual, the faster the reaction times because, theoretically, as the muscles become stronger, external resistance has less retarding effect on speed. Several research groups studied the effects of various exercise programs on reaction time. They found that high-resistance isotonic contractions produced a 13% improvement in reaction time, and that high-resistance isometric contractions produced improvement in reactions by 6%.

Whitney and Smith found that regardless of the kind of strengthening exercises used, any increases in the strength of the muscles involved in a particular task made it possible to perform the movement faster. We can say that year-round strength training should be incorporated into the overall conditioning program for the basketball player.

In general, studies suggest that moderate levels of exercise have a beneficial effect on reaction times due to a rise in core temperature, which, in turn, leads to an increase in the speed of nerve transmission.

This improvement in cognitive performance during moderate exercise is often explained by a positive effect of increased arousal induced by exercise.

This may be explained by Easterbrook's cue-utilization theory. According to this theory, a moderate increase in arousal could lead to a narrowing of attention onto task-relevant cues, and therefore, to better performance.

On the other hand, high intensity or heavy exercise resulting in fatigue appears to have an inhibiting effect on reaction times.

Hypothetically, this could be explained by the resultant high levels of catecholamine, which could result in random firing of the nerve cells in the central nervous system.

There, apparently, is an optimal arousal state induced by exercise that can positively impact cognitive performance, thus enhancing reaction time.

Conversely, the opposite can be said if the athlete becomes fatigued due to heavy exercise or a high arousal state, leading to impaired cognitive performance and slower reaction times.

It is important to be cognizant of the athlete's total conditioning program in order to avoid overtraining, and an impairment of reactive ability.

Obviously, when an athlete is fatigued, she will tend to focus on her perceptions of discomfort rather than on the task at hand. Periodization of the overall program, as well as a variation in daily workouts must be considered in order to avoid any detrimental effects on the athlete's ability to react.

RECOMMENDATIONS

It appears that several physiological factors are involved in an athlete's ability to react. It would, hence seem prudent, as well as beneficial, to remain cognizant of sensory-motor integration when developing specific conditioning drills for the basketball athlete. Because the sport is multi-planar, the drills should be multi-planar as well. The following reaction-based performance drills may be beneficial to incorporate into training and/or assessing an athlete and would incorporate both the lateral and frontal planes: six-foot shuffle, nine-foot shuffle, nine-foot crossover, drop-step-and go, and free-throw to free-throw.

It is suggested that the coach use an automated directional display device (for example, The ReAction Coach[TM] from S.T.A.R.T. Technologies, NY, to conduct these training drills. However, a manual visual signal and a stopwatch can also be utilized. In response to a randomly displayed directional cue, the player should complete each drill for a minimum of nine repetitions. Time to complete each repetition is recorded. (If using a manual method, a coach will need a timekeeper to record the times of completed repetitions.) An athlete can signal a completed repetition by using an implement, such as a plastic baton in each hand.

CONCLUSION

Most conditioning programs include some form of agility training. Research has supported the benefits of agility training for basketball players or any athlete involved in sports requiring this skill as well as speed, quickness, coordination, and acceleration.

Adding a component of reaction-based training may have even further benefits. Repetitive practice of any skill leads to the refinement of that skill.

Decreasing an athlete's reaction time, or the time it takes for the athlete to make a decision, will ultimately decrease movement time and increase speed and quickness.

Incorporating some sort of cue, which the athlete is forced to react or respond to, into the agility-training component, may enhance the overall conditioning program.

The practice of reaction-based drills, will improve the athlete's skill in her ability to react to a cue, and more importantly, to improve her quickness.

Generally, quickness, of which reaction is a part of, is genetically determined. However, as with any other skill, it can be improved through practice and training.

It may then follow, that reaction time may be improved with practice and training.

If an act is practiced enough, a conditioned reflex may follow.

That is the ultimate goal of reaction-based training: rehearsing and repeating an action over and over to create habitual or automatic movements wherein the athlete doesn't have to think before acting or moving.

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