

Speed Training

Speed is important for most sports, because the majority of athletes must either run, move, react, or change direction quickly. The term speed incorporates three elements, including reaction time (the motor reaction to a signal), movement time (the ability to move a limb quickly, as in martial arts, batting, or passing a ball), and speed of running (including the frequency of arm and leg movement).

In team sports an athlete rarely performs a straight line action, such as sprinting in track and field. Players are highly regarded if they can quickly change directions to receive a pass or to deceive an opponent. In either case, elements of speed are combined: here, they are reaction time and speed of running in different directions. Additionally, take for instance a quick arm or leg action in martial arts, in which an athlete is either delivering a fast blow or quickly reacting, and as a result blocking or avoiding a fast blow. In either case, such an athlete has to be fast, or have a fast movement time. This is why it is important to understand, and to train, the different elements of speed.

Each sport has its type of specific speed and quickness training. However, parents and coaches can help their young athletes by performing additional speed work. The examples at the end of this chapter will assist in your quest for speed gains.

Many sports specialists believe that sprinters are born, not made, because speed is largely genetically determined, depending on the athlete's muscle-type composition. The higher the proportion of fast-twitch to slow-twitch muscle fibers, the faster the reaction and more powerful the muscle contraction. Although speed is associated with genetics, genetics are not the limit. There are ways to develop speed through training. Even athletes who do not have a natural talent in speed-related activities can significantly improve their speed. It is important for future athletes to emphasize speed training during childhood. Running speed, reaction time, and quick footwork improve continuously from five years of age to maturity.

Speed improvement also depends on the ability of muscles to contract forcefully, so the body or a limb moves fast. Therefore, a forceful contraction in any type of quickness or speed relates to strength training. Because children's strength is visible mainly from puberty on, they achieve most gains in speed during puberty and postpuberty. However, speed improvements are visible also during prepuberty, as a result of neural adaptation, meaning that as children perform quickness and speed activities, the muscles learn to work together and become more effective. Therefore, speed gains during prepuberty are not the result of powerful muscle contractions but the outcome of neuromuscular adaptation.

Speed Training Model for Initiation

The ability of prepubescent children to perform quick motions increases progressively in this early stage with both boys and girls developing speed in the later stage. Most speed gains come not only from learning the sprinting skills, but also from developing a better muscle coordination.

Some children, especially those who do not experience multilateral development, may have poor arm and leg coordination. Because arm drive directly influences the leg frequency, a low level of coordinating arm and shoulder force impedes the ability of children to run fast.

Gender differences in running speed are not visible during early prepubescence. This starts to show as children approach puberty, with the trend being that boys perform speed-related activities better than girls. Other forms of speed and agility display the same tendency (Bailey, Malina, and Mirwald 1985; Hebbelinck 1989).

Scope of Speed Training

One main goal of prepubescent sport activities is to develop a play-specific speed. Through exposure to play, games, and relays, children will learn how to coordinate their arms and legs, make them move faster, and run on the balls of the feet. Children's movement time will improve as a result of such motor experiences. They will learn how quickly to start moving parts of the body at a signal or in a play situation.

Prepubescent speed development is mainly the result of nervous system adaptation children achieve through play and games. As a result of this motor experience, the nervous system learns how to coordinate the actions of the arms and legs most effectively. Consequently, a child will progressively cover a certain distance, change directions, and react more quickly.

Children enjoy knowing that they are fast. They have fun and like performing physical tasks in which speed is important, both during play and relays. Variety, in speed exercises is important because it improves motor experience. At the same time, children should not neglect the upper body. Simple throws using a tennis ball or light medicine ball are useful for developing upper-body movement time.

As children improve their limb coordination, they can progressively participate in simple speed drills, especially as they approach puberty. Similarly, for those involved in organized training, like team sports, the instructor can perform specific drills for speed, in most cases using a ball. The instructor can organize

sport-specific drills as part of training, and children can perform other types of speed training in addition to the technical work (see the exercises at the end of this chapter).

Unless children participate in gender-specific teams, most games, plays, and relays, especially in the school curriculum, should be coed, because at this development stage there are no visible differences between boys and girls (Bailey, Malina, and Mirwald 1985).

Program Design

You should view any speed training program for prepubescence as an early nervous system adaptation to a variety of movements. As the nervous coordination of the muscles improves, so will the children's capacity to be faster.

The duration of a drill or the distance to run should not be long. Children should not experience discomfort at this age. They should not run fast and continuously for longer than four to six seconds, because longer distances require specific training. If they pause for two or three minutes, then they could repeat the same action with enjoyment. There is no fun when there is discomfort and pain.

Instructors should plan training programs for speed, like anything else, over several years. The instructor should use a variety of exercises that involve the whole body and stimulate running speed and movement time for both arms and legs. Play, games, and relays should be the major elements to improve speed for prepuberty.



Athletes should increase distance progressively over years, from 20 meters or yards to 40 to 50 meters or yards, especially for children who are approaching puberty. Children should perform primary running exercises in a straight line. As children approach puberty and become stronger, you can incorporate running in zigzag, stop and go, slalom, and with quick turns in training. Stop and go is a speed drill in which the athletes run as fast as possible for 5 to 15 meters or yards, and at the signal "stop," they stop running as quickly as possible. At the signal "go," they run as fast as possible in another direction, which the instructor points out, for a further 5 to 15 meters or yards.

To improve upper-body movement time, I advise throwing tennis balls, medicine balls, and baseballs. Also, relays using medicine balls for throwing and carrying will benefit upper-body strength, which will later positively influence movement time. For further information on these exercises, please see chapter 6, "Strength and Power Training".

In team sport training, or during games, the instructor can combine speed tasks with skill performance such as throwing and kicking the ball. Such drills are typical combinations for developing running speed and movement time. Prepubescent children have good trainability for speed, especially as they approach puberty; however, you should carefully plan and progressively implement everything.

Table 5.1 incorporates several elements of speed training useful in most sports. Under the column "Forms of training" are the types of activities children can perform; "Duration or distance of activity" suggests how many minutes, meters, or yards to run. The next column suggests how many times to repeat an activity. Finally, between repetitions, children need to rest, relax, and avoid an undesirable stress for this age.

For prepuberty, the duration of a game does not have to be longer than 20 or 30 minutes. In hockey or soccer, children can play the game for two periods. I do not advise prepubescent children to play a game for the same duration as adult athletes, because at this age children do not have the conditioning potential to play a 90-minute soccer game or three 20-minute hockey games. An exhausted child hardly thinks about the next game, whereas one who has been tired but enjoyed it is eagerly waiting for the next game.

Children can easily repeat relays performed over 10 to 15 meters or yards three to five times, especially if they use different relays. However, irrespective of how eager children may be to repeat it, make sure they have a rest interval between relays to rest and relax.

For team sports, speed training has to take the form of running with turns, direction changes, and stop and go. Because the distance for this type of work is not long, children can perform more repetitions (four to eight) with a two- or three-minute rest interval between them. The structure of a workout for speed training may follow the example of table 5.2.

Speed Training Model for Athletic Formation

Speed development increases during puberty. Most children experience an acceleration in speed development during this stage, a phenomenon that is valid for

Table 5.1 Periodization Model for Speed Training for Prepuberty

Forms of training	Duration or distance of activity	Number of reps	Rest interval (min)
Games	20-30 min	1-2	—
Relays	10-15 m/(10-15)yd	3-5	2-3
Speed training	10-50 m/(10-15)yd	4-6	3-4
Speed training with turns, changes of direction, and stop and go	5-15 m/(10-15)yd	4-8	2-3

Table 5.2 Speed Training Session

Part	Objective	Exercises	Duration or number of reps
1	Warm-up	Same as table 4.1 (pg. 47)	10 min
2	Improve speed		6 × 25 sec
	Improve game-specific speed	• Short and fast technical/tactical drills with quick direction changes • Play/game/scrimmage with technical/tactical goals	8 × 15 sec 20-30 min
3	Cool-down, relaxation, enjoyment	• Relays • Relaxed, easy jogging	3 reps 3 min

both boys and girls. Such improvement may relate to increase in body and muscle size.

Strength gains positively influence speed development. From puberty on, the testosterone level in boys starts to increase dramatically, along with the ability to increase strength. The direct result of strength gains is improving speed, both running speed and movement time.

Although boys show clear improvements from the later stages of pubescence, girls seem to plateau in their rate of speed development. Some speed gains can result from improved nervous system coordination of the muscles involved in quick actions. Most of it, however, is the consequence of strength development and the ability of the muscles to contract more powerfully. As a result, the arms can drive more forcefully and the legs can push with more power against the ground.

Gains in upper-body power, especially the arms, improve movement time, reflecting the ability to throw the ball farther or to bat more powerfully. On the

other hand, improved leg strength translates into kicking the ball with more power. For most team sports in which running speed is important, the ability to quickly change directions is also significant. This skill is the result of improved nervous system coordination and strength gain of the muscles involved.

Scope of Speed Training

Speed training during puberty has to become specific to improve it to higher levels. However, it should still be part of a multilateral athletic development, and children should do it in connection with developing other abilities.

During puberty, quickness and high acceleration training lead to a better nervous system adaptation, which results in enhanced coordination of muscles performing the arm and leg actions. As strength starts to improve, especially for boys, movement time increases, which influences upper-body quickness and running speed. Similarly, as leg strength improves, children start to push more forcefully against the ground and are able to drive their bodies forward much faster.

Although coed speed training may occur during prepubescence, I advise that you separate the genders starting from pubescence. As mentioned, from puberty on, boys become stronger, which positively influences the rate of limb movement and speed. As a result of these differences, it is better for girls and boys to train in separate groups.

Program Design

As children approach postpubescence, they can increase the total amount of speed training. Whether using exercises such as play, games, relays, or even sprinting routines, they can progressively increase the distance run with high velocity from 20 to 50 or 60 meters or yards.

Speed training can be fun for children and instructors alike. You can perform a variety of exercises involving play, games, and especially relays. You can organize relays in ways that use many exercises, such as sprints, sprints with turns, runs around cones with direction changes, carrying or throwing medicine balls, or jumps over safe equipment at a low height.

You ought to organize special exercises to improve reaction time as well. The intention is to decrease the time it takes for the child to move a limb, for instance, the arms and legs in running or the arms in throwing a ball. You can achieve such a goal in two simple phases:

1. During the early part of improving movement time, the instructor positions him or herself in front of the children, facing them. At his or her signal, visual (clap) or sound (whistle), the children perform the task. Because children can see the instructor, they can start the action faster.
2. As children improve their reaction time, after a few months or one to two years, the instructor will select a position behind the children so he or she can see the children but cannot be seen. Now the children will rely on sound only. The purpose of this exercise is the same; at the signal the children perform the task as quickly as possible.

Parallel with speed and movement time exercises, children should participate in simple exercises for power improvement. For the upper body, they can use a

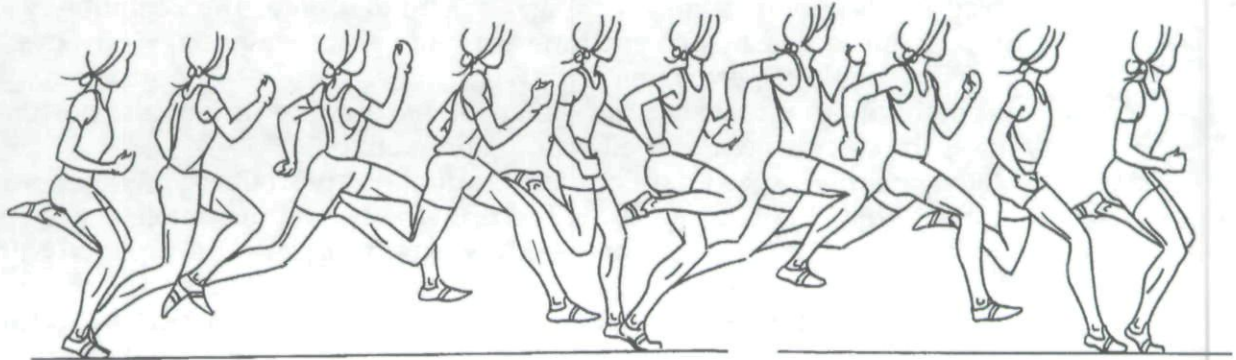
Teaching Correct Running Technique

To improve running efficiency, athletes should work on running form technique. A crucial component in achieving such a goal is good arm drive. Arms are driven back, forward, and up to the face level. The leg frequency increases as the rate of the arm drive increases, because the rate of leg movement is led and coordinated by arm drive and frequency. The thigh of the driving leg (for our example, this will be the right leg) should reach a horizontal line; from this point on the foot of the same leg is projected forward and down. The back of the foot lands on the ground through a brushing action. As the body moves forward, the other (left) leg is driven forward. The right leg is now pushing against the ground, projecting the body forward. These actions are repeated for as long as the sprints last.

As children perform these exercises, the instructor or teacher should constantly observe them for good

form, keeping shoulders down and relaxed, driving the arms simultaneously, and bringing the knees high. The position of the body is vertical, with the eyes focused ahead. The foot strikes the ground quickly, coming underneath the body as it moves forward. The running step has the following phases:

1. The propulsion phase, pushing against the ground with power to drive the body quickly forward.
2. The drive phase, in which the opposite leg drives forward, with the thigh horizontal. The opposite arm also drives along the body, with the hand at shoulder height (arms are bent at 90 degrees). It is essential to keep the ankle locked up to the landing phase.
3. Landing phase, as the foot strikes the ground, it quickly comes underneath the body.
4. Recovery phase, when the heel of the propelling leg quickly drives toward the buttock while the opposite arm quickly moves forward.



variety of medicine ball throws. Similarly, tennis and baseball throws for distance, alternating the arms for balance development, are fun and beneficial for upper-body power development. Children can develop leg power by performing simple jumps on, off, and over low and safe equipment. (Please refer to chapter 6, Strength and Power Training)

As postpubescence approaches, children can progressively increase to the maximum intensity (speed) and power of exercises to improve neuromuscular coordination. They can follow the same trend for the number of repetitions. As children show better adaptation to training, they can increase the number of repetitions, depending on their work tolerance capacity.

A critical element in speed training is the duration of the rest interval between repetitions. Because the ability to repeat high-quality exercises depends on the freshness of the neuromuscular system, the rest interval between repetitions must

be as long as necessary to achieve almost full recovery and restoration of the fuel needed to produce energy.

As table 5.3 illustrates, you can use relays for developing speed for pubescence, but of longer distance than for prepuberty: 10 to 30 meters or yards, repeated four to six times, with a rest interval of two or three minutes. Children can repeat speed training in a straight line of 20 to 50 meters or yards five to eight times with a longer rest interval, four or five minutes, between each repetition. During the rest, stretch the muscles for a better relaxation. For team sports, children can perform speed training with changes of direction, turns, and stop and go for 5 to 25 meters or yards, repeated 5 to 10 times, with a rest between them of two or three minutes. Game-specific skills performed fast also develop specific speed.

If in a training session children repeat just speed training, or speed with turns and direction changes, the number of repetitions can be much higher, after which the coach will do either technical and tactical drills, play games, or scrimmage.

The structure of a training session for pubescent children can be the same as table 5.2, with the difference that duration and the number of repetitions will follow table 5.3.

Speed-Training Model for Specialization

Speed improvement comes with age. As children enter the postpuberty stage, gains in speed and movement time are more visible, especially for boys. Girls show the highest speed gains during late puberty and early postpuberty. From this point on, they seem to reach a plateau that may last throughout postpuberty unless they implement a speed-training program.

Boys maintain speed development throughout postpuberty. As they become stronger, they also become faster. Probably the biggest difference between boys and girls is in the area of upper-body strength, because from puberty on the upper-body strength gains of boys are constantly increasing.

For children involved in sports, speed gains may also relate to improved muscle coordination. As a result of multilateral training, they learn how to use their muscles and how to coordinate them for the best efficiency. As such, speed improvement also comes from better muscle and limb coordination. In addition,

Table 5.3 Periodization Model for Speed Training for Puberty

Forms of training	Distance of activity	Number of reps and sets	Rest interval (min)
Relays	10-30 m/yd	4-6	2-3
Speed training (including starts)	20-50 m/yd	5-8	4-5
Speed training with turns, changes of direction, stop and go	5-25 m/yd	5-10	2-3

the nervous system learns to be more selective in choosing how fast and in what manner to react to an athletic situation. As a result of processing the signal or a game situation, the nervous system selects the action and stimulates the necessary muscles to contract and perform the quick movement.

Scope of Speed Training

Postpubescence speed training should become specific and relate to the needs of the selected sport. Reduce the play and game approach to leave time for sport-specific speed training.

For any athlete who intends to climb the ladder of high performance, postpubescence is the key link. On the one hand, anything the athletes missed during the first two stages of development, they can still correct. On the other, failing to address the sport-specific needs of speed training during prepubescence can drastically impair athletes' chances of reaching high performance. Although speed training becomes progressively more sport specific according to the athletes' needs, they should not totally dismiss fun and elements of multilateral training.

Most speed training has to be dynamic and performed with high intensity to constantly stimulate the neuromuscular system. This type of training will result in running with higher leg frequency and velocity.

A constant concern in speed training is for the athlete to learn to relax his or her antagonistic muscles as the agonistic muscles contract to perform the movements. Allot special time for training lessons in which athletes learn how to relax and perform smooth, easy, flowing, and well-coordinated skills or movements. This is possible by first performing repetitions of speed work with lower velocity, so the athlete can concentrate on relaxing the antagonistic muscles. As they achieve this, they can progressively increase the velocity until they can do the same repetition with maximum velocity. However, athletes will not achieve this training goal in a day, a week, or even a month. Sometimes it may take one or two years. Considering the benefits of learning to run smoothly, relax, and perform flowing actions, it is worth the time. If athletes do not do this at this development stage, they will run rigidly. Rigidity means higher energy expenditure and unnecessary muscle contraction that lowers velocity.

From the later stages of postpubescence, the coach has to apply annual periodization and planning. From this point on, the teacher must organize a training program to meet the needs of training for a well-defined competitive season. The coach will have a preparatory (preseason) training phase maintaining multilateral training and addressing compensation work for certain muscle groups. From late preparatory and throughout the preparatory phase, training is specific, with the coach or teacher using mostly exercises and drills that will directly improve performance. Finally, the last phase of the annual plan, transition, or off-season, training will once again be multilateral, informal, and relaxing. This is the time for removing fatigue, relaxing mentally, and maintaining some physical activity, play, and fun.

Program Design

Postpubescent speed training is more complex than what I suggest for the other two developmental phases. In addition to speed training, to meet the needs of

speed and movement time development, you must train the following elements as well:

- **Speed:** High-velocity, high-frequency training, with highest intensity should be an important part of the total time dedicated to speed training.
- **Movement time:** This is elapsed time between the first overt movement of a response and completion of that movement (Anshel et al. 1991). Movement time is not only a muscular reflex to a stimulus but also the ability of the muscles to contract quickly and powerfully. Training, both speed and power, will greatly improve the ability to move a limb quickly.
- **Ability to overcome external resistance:** In most sports, power—the force of a muscle contraction—is a determinant factor in performing fast movements. During training and athletic competitions, external resistance to the athlete's quick movements exists in the form of gravity; the apparatus; the environment such as water, snow, wind, and so on; and the opponents. To defeat such opposing forces, athletes have to improve their power, so that by increasing the force of muscular contraction, they can increase the acceleration of skills. As part of training to overcome external resistance, athletes must improve the explosiveness of kicking, hitting, throwing, and batting.
- **Technique:** The speed frequency of a movement, and movement time, are often a function of technique. Acquiring a rational, effective form facilitates performing a skill quickly, correctly, and efficiently. Athletes must also give an important role to performing a skill with ease and coordination as a result of consciously relaxing the antagonistic muscles.
- **Concentration and willpower:** It seems that rapid movements are facilitated by a high degree of power. Consequently, the quickness that the central nervous system processes the athletic information coming to it, the frequency of the nervous impulses, and the athlete's maximum concentration determine the speed of a movement. The athlete's willpower and maximum concentration are important factors for achieving high speed.
- **Muscle elasticity:** Muscle elasticity and the ability to relax the agonistic and antagonistic muscles alternately are important factors in achieving high frequency of movement and correct technique. In addition, joint flexibility is an important ingredient for performing movements with high amplitude (i.e., long strides), which is paramount in any sport requiring fast running. Consequently, including daily flexibility training is imperative, especially for calf and thigh muscles.

Table 5.4 exemplifies a periodization model for speed training for postpuberty. Although the table refers to many training forms, you may select only those required in the sport of your interest.

Perform high starts standing, feet apart, in a ready position. At the signal or athlete's decision, he or she will accelerate as quickly as possible for 10 to 30 meters or yards, repeating the same action 6 to 10 times, with a three- or four-minute rest interval, when relaxation and easy stretching would maintain muscle elasticity. High starts are important for all team sports in which players are constantly in the situation to perform quick accelerations: soccer, football, baseball, hockey, lacrosse, and basketball. High starts can be performed separately from

Table 5.4 Periodization Model for Speed Training for Postpuberty

Form of training	Distance of activity (m/yd)	Number of reps and sets	Rest interval (min)	Number of speed training sessions per week
High starts	10-30	6-10	3-4	1-2
Maximum speed	20-60	4-8	3-4	2
Speed endurance	60-120	3-6	4-5	1-2
Sport-specific speed				
Accelerations	10-30	4-6	2	2-3
Decelerations	10-20	4-6	2	2
Stop and go	10-20	4-8	2	2-3
Accelerations with direction changes	10-30	4-8	2	2-3
Ballistic training (throwing, kicking, jumping, etc.)	—	2-4 sets; 5-10 reps	1-2	2-4

Note: Because these workouts are taxing, be aware of how many types of training are possible per day. Plan two to four forms of training per session, depending on the athlete's potential. The balance will be on technical or tactical work. Tables 5.5 and 5.6 give clear examples of what types of training to perform on different days of the week.

technical or tactical training in order to improve a fast start, or part of a specific drill.

Acceleration training to increase maximum speed over 20 to 60 meters or yards, four to eight times, with a rest interval of three or four minutes represents a training form that increases maximum acceleration for both sprinting and team sports. Speed endurance on the other hand, represents a form of training in which the scope is to maintain maximum velocity over a longer distance (60 to 120 meters or yards), repeated three to six times but with a longer rest interval (four or five minutes), because this type of training is taxing physically and mentally. This form of training is important for wide receivers in football, baseball players, and track athletes.

Athletes must do speed training with sport-specific forms, such as using a ball in most team sports, and so on. For team sports, deceleration, or a quick stop from fast running, is as important as the ability to accelerate maximally. Because in team sports athletes will rarely accelerate in a straight line, they must perform many sport-specific forms of training with turns, direction changes, and stop and go. The distance does not have to be long—10 to 30 meters or yards—repeated four to eight times. The rest interval is not long (two minutes) to train the athlete to be able to accelerate-decelerate not only when rested, but also in conditions of fatigue. After all, this is the case in all the team sports.

In ballistic training, athletes must perform dynamic, powerful throws, passes, kicks, hits, jumps, and so on, for example, 5 to 10 repetitions, in two to four sets, with a one- or two-minute rest interval. Most team sports use these skills, for which athletes often train under the condition of fatigue.

I must also mention two important training elements. First, athletes do not have to train all forms for all sports or in the same training session. Sprinters in track and field may perform starts and maximum speed in the same workout. However, because of its difficulty, speed endurance is trained in separate sessions from any other types of training. Wide receivers in football and baseball players would train high starts, acceleration speed, and accelerations with changes of directions in the same workout, (in the case of baseball, changes of direction mean running around the diamond). Speed endurance, on the other hand, is performed on separate days, with sport-specific form (changes of directions).

For most other team sports athletes, the forms of training can be combined in the following way.

- **1-2 days per week:** high start sprints, maximum speed training, and acceleration with changes of direction.
- **2 days per week:** acceleration and deceleration, and stop and go sprints.

The examples in table 5.5 and 5.6 further clarify this. Second, strength and power training, as suggested in chapter 6, will help the athletes to improve maximum speed and movement time.

As mentioned previously, from postpuberty on, the coach or instructor can start using annual periodization models. From this stage, athletes start to participate in more formal competitions, and training must follow a structured program. You must base such a program on the concept of periodization as in tables 5.7 through 5.9.

Looking at the models in tables 5.7 and 5.8, you can see that the progression for speed training starts from short-distance repetitions, in which the athlete seeks best form and maximum velocity for that development stage. When athletes reach this, they should progressively increase distance up to that required in the chosen sport or in a dash race.

In team sports, the longest distance that athletes must run with maximum velocity depends on the position they play in the team. For instance, wide receivers or baseball players run with maximum velocity up to 80 meters or 87 yards. In soccer, distance decreases to 40 to 60 meters or yards, whereas in basketball, the distance is not longer than 15 to 20 meters or 16 to 22 yards, unless the athlete returns to his or her own basket in the same velocity.

Irrespective of how far the athlete runs with maximum velocity, you should organize special sessions for speed training that follow the concept of periodization and incorporate elements of maximum speed, speed power, and speed endurance. These types of training programs will make an athlete a fast runner, with good acceleration.

For team sports, the ability to accelerate quickly is not sufficient. The players have to be able to change direction and decelerate quickly so they can turn around and immediately accelerate in another direction. The stronger the legs, the faster an athlete can accomplish this; therefore, an athlete should participate in strength training simultaneously with speed training.

Finally, here is a comment before I suggest some periodization models. This refers mostly to sprinters and wide receivers. In a 100-meter standard dash, you do not achieve maximum velocity at once, and it is not the same throughout the race or run. From the instant of the start, it takes an athlete four to five seconds to build up the highest speed, which depends on leg power. In fact, the analysis of a

Table 5.5 Sample Training Plan for Maximum Acceleration—Individual Sport

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
• Warm-up • Starts 6-10 times 10-30 m RI = 4 min • Power training	• Warm-up • Maximum acceleration 6 × 30 m/yd 4 × 50 m/yd 3 × 60 m/yd 4 × 30 m/yd RI = 4 min	• Warm-up • Speed endurance 4 × 60 m/yd 2 × 80 m/yd 2 × 120 m/yd 2 × 40 m/yd RI = 5 min • Power training	Off	• Warm-up • Starts: 4 × 10 m/yd 2 × 20 m/yd 2 × 30 m/yd • Maximum speed: 3 × 40 m/yd 3 × 60 m/yd RI = 4 min	• Warm-up • Speed endurance 2 × 80 m/yd 2 × 120 m/yd 4 × 60 m/yd RI = 5 min • Power training	Off

Notes: For power training, refer to chapter 6. Power training may be performed in the morning separate from speed training.
Distance expressed in m/yd.
Light stretching during RI.
RI = Rest interval.

Table 5.6 Sample Training Plan for Maximum Acceleration—Team Sport

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
• Warm-up • T drills acceleration-deceleration 10 × 30 m/yd • T drills with turns/direction changes 12 × 30 m/yd • Scrimmage RI = 2 min	• Warm-up • TA drills direction changes, stop and go 16 × 3 min • Scrimmage RI = 2 min • Ballistic training	• Warm-up • T drills maximum acceleration 6 × 15 m/yd 6 × 30 m/yd RI = 4 min • TA drills 12-14 × 1 min RI = 2 min • Ballistic training	Off	• Warm-up • T/TA drills for speed and agility 12 × 30 m/yd RI = 4 min • T/TA drills with turns, stop and go 8-10 × 1 min • Scrimmage • Ballistic training	• Warm-up • Accelerations with turns 6 × 30 m/yd • Acceleration-deceleration 8 × 30 m/yd • Stop and go 10 × 30 m/yd RI = 2 min	Off

Notes: On Saturday the program is performed individually, outside of the gym/ice arena.
Add power training on Monday, Wednesday, and Friday as per examples in chapter 6.
You may organize power training on Monday, Wednesday, and Saturday morning, separate from specific training.
T = Technical drills.
TA = Tactical drills.

100-meter dash illustrates that athletes reach peak velocity at the 50- to 60-meter mark and maintain it up to 80 meters or yards. From that point on, there is a tendency to decrease velocity. In the early part of the race, high acceleration depends on power and speed power, whereas from 70 to 80 meters on, speed endurance is required to maintain the velocity.

From this brief analysis of sprinting speed, you will observe that speed training is slightly more complicated than it may look. You must know the three segments that compose a race, what you require to perform well in all parts, and, therefore, which elements of speed you must train to become a fast runner (acceleration, maximum speed, and speed endurance). Table 5.7 illustrates a periodization model of an annual plan for speed training for a postpubescent athlete, when he or she must reach peak performance in June and July.

In the top of the chart are the months of the year and the structure of training phases. Below that are the types of speed training, distance, and percentage for a given segment of the plan. The program starts with long tempo, or a type of training in which the athlete does repetitions of 400 meters at the beginning, and 200 meters at the end, repeating this 8 to 12 times at 50 percent of maximum velocity. The scope of this type of training is developing an aerobic-anaerobic base. The same training scope is planned in the next segment of the preparatory phase (late November to mid-January), but the velocity is higher: 8 to 19 repetitions at 60 to 70 percent of maximum velocity.

On the base created during the months of October to mid-January, athletes progressively increase speed training to peak for the months of June and July. Developing maximum velocity should start from short distance in late January and February and progressively increase to full distance as competitions approach.

The distance athletes repeat to increase maximum velocity depends on the form of running. In fact, running form dictates the distance and the number of repetitions the athlete performs. In the early part of this phase, athletes repeat distances of 15 to 20 meters, requiring them to keep a relaxed and correct form. When the athletes cannot maintain form, they are fatigued, and the power of fast running is not there anymore.

When athletes can maintain the form for 30 to 40 meters, then you can plan repetitions of longer distances (40 to 60 meters), in our case from early March to mid-April. At the same time, the coach can plan low starts of short distance (10 to 15 meters) with 80 to 100 percent of maximum power and speed. Always demand a good form.

After three months of speed training with short and medium distances, the athlete can start to perform repetitions of 60 to 80 meters or yards. Focus on good form and extend the distance when athletes are to maintain maximum velocity. From this point on, throughout the competitive phase, the athletes participate in full distance or distances longer than the racing distance (overdistance) to develop maximum velocity and speed endurance.

During the months of April through July, the number of repetitions depends on how much work the athlete can tolerate and the fatigue level he or she experiences. As competitions approach, it is better to undertrain than to overtrain the athlete. Maximum velocity is possible only when the athlete is rested, fresh, and unstrained.

The lowest two rows of table 5.7 show the types of speed and power training the athlete must develop throughout the year if he or she expects to perform well in June and July.

You do not have to apply the suggested plan (table 5.7) rigidly. Climatic conditions and athletes' training potential may call for some changes. However, irrespective of changes in the plan, please follow the suggested progression and type of training.

The difference between tables 5.8 and 5.7 is that the former plan has two competitive phases: indoor competitions from January to early March and outdoor races from late May to the end of July. Between them, there are two weeks of transition in mid-March.

The progression for each peak is similar to table 5.7, except that each phase is shorter, so that two peaks are possible. All the other elements of training are similar to table 5.7.

The plan that table 5.9 illustrates has many similarities with table 5.7: the same regression regarding the training distance, from long tempo to short tempo, culminating with specific speed for August and September. During these last two months of the preparatory phase, athletes do most speed training by repeating specific technical and tactical drills, or doing speed-specific training for team sports, such as turns, changes of direction, and stop and go. This type of speed training has to train the players for a game, which is dynamic, and quick changes of speed, from jogging to maximum acceleration. The progression for power training has to support gains in specific speed for a team player that he or she must maintain throughout the league games.

You can easily adapt the example in table 5.9 to team sports in which the competitive phase is in the spring and summer months (soccer, baseball). In such a case, plan the preparatory phase for the fall and winter months and the sport-specific speed and power for March and April.

Exercises

In this chapter I present 26 exercises and games that will help young athletes develop speed and agility. These exercises (pages 81-91) are appropriate for all ages. Keep in mind that while athletes are performing the relay in this chapter, the instructor should insist on good running form (see page 69) and emphasize skills over winning.

Table 5.7 Periodization Model for Speed Training for Postpuberty

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Training phase	Preparatory						Competitive					
Types of speed training, distance, and percentage of max. velocity	Long tempo 8-12 times 400-200 m/yd at 50%	Long tempo 8-12 times 400-200 m/yd at 50%	Short tempo 8-19 times 200-100 m/yd at 60-70%	Reps 20-40 m/yd at 95-100%	Reps 20-40 m/yd at 95-100%	Reps 40-60 m/yd at 95-100% Low starts of 10-15 m at 80-100%	Reps 60-80 m/yd at 90-100% Starts of 20-40 m at 90-100%	Reps 60-80 m/yd at 90-100% Starts of 20-40 m at 90-100%	40 m/yd to full distance, or overdistance without or with starts	40 m/yd to full distance, or overdistance without or with starts	Other physical activities Play/games	Transition
Speed training	Anaerobic endurance						Maximum speed					
Power training	Power endurance						Starting power					
Speed training	Anaerobic endurance						Maximum speed, maximum acceleration, speed endurance					
Power training	Power endurance						Starting power, power endurance					

Note: Annual plan for speed training for a postpubescent sprinter, where peak performance must be reached in June and July. AA = Anatomical adaptation

Table 5.8 Periodization Model for Speed Training for Late Postpuberty

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Training phase	Preparatory			Competitive			T	Preparatory		Competitive		Transition
Types of speed training, distance, and percentage of max. velocity	Long tempo 400-200 m/yd at 50-60%	Short tempo 200-100 m/yd	Reps 20-40 m/yd at 95-100%	Reps 40-60 m/yd at 95-100%				Short tempo 200 m/yd at 75%	Reps 40-60 m/yd at 95- 100%	Reps 60-80 m/yd at 95- 100%	40 m/yd to full distance Overdistance	Other physical activities: play/games
Speed training	Anaerobic endurance			Maximum speed Maximum acceleration			/	Anaerobic endurance	Maximum speed Maximum acceleration	Maximum acceleration Maximum speed Speed endurance		
Power training	Power endurance			Starting power			/	Power endurance	Starting power	Starting power Power endurance	AA	

Notes: Annual plan for speed training for a late postpubescent child.

T = Transition phase

AA = Anatomical adaptation

Table 5.9 Periodization Model for Speed Training for Postpuberty for a Team Sport

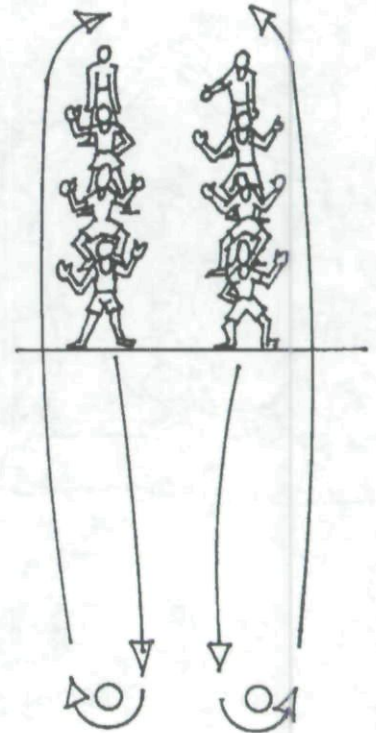
Month	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April
Training phase	Preparatory			Competitive			Transition					
Types of speed training, distance, and % of maximum velocity	Long tempo 600 m at 50% 400 m at 60%	Short tempo 100 m-200 m at 65%	Short reps 20-30 m/yd at 90-100% Specific drills 20-90 sec at 95-100%			Maintain maximum speed and acceleration			Other physical activities play/game, outdoor activities			
Speed training	Anaerobic endurance			Maximum speed: turns, stop and go, direction changes			Maintain maximum speed using specific drills/scrimmages					
Power training	Power endurance			Power: acceleration and deceleration			Maintain power: acceleration and deceleration			AA		

Note: The league games are planned for October-January (i.e., basketball, volleyball, hockey, etc.).

FILE RELAY

Focus: running form and velocity

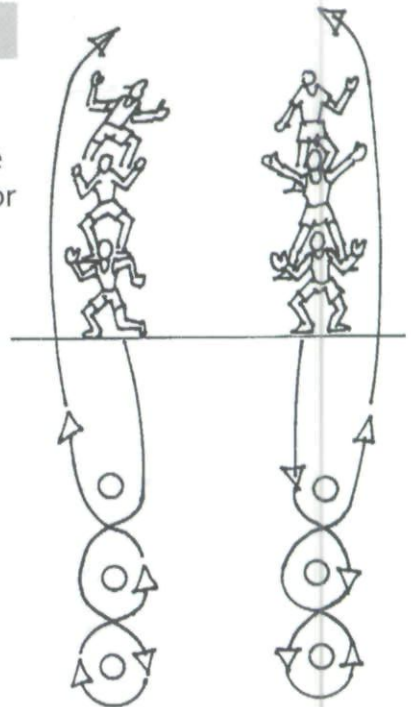
1. Organize a group of players in two or more relay teams of 8 to 10.
2. They stand behind the starting line, and at the instructor's signal, the first player in each file runs as fast as possible up to a cone 10 meters or yards in front of each team.
3. After turning around the cone, the player runs back toward the starting line, touching the hand of the next player in line. No player can start his or her run before touching hands.
4. Every time a player finishes running, he or she goes to the back of the line.
5. The winning team has to finish the relay faster than the others and be lined up as they started the relay.
6. You can organize file relays to perform skills such as running, carrying a ball, rolling a ball all the way, hopping, and so on.



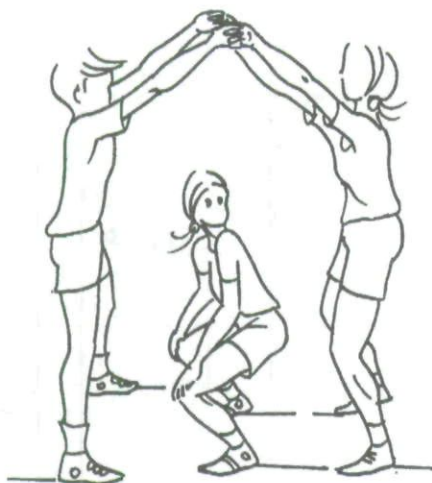
SLALOM RELAY

Focus: fast running with turns around cones

1. Whether using balls to roll, carry, or dribble, slalom relays have the benefit of developing running speed with turns, which is beneficial for team sports. Organize it as the file relay, except that players perform a slalom run between several cones placed in front of each team.
2. As in the file relay, players can run, dribble a ball, carry a medicine ball or any other object.
3. The rules of the file relay apply to any relay race.



FOX AND SQUIRREL



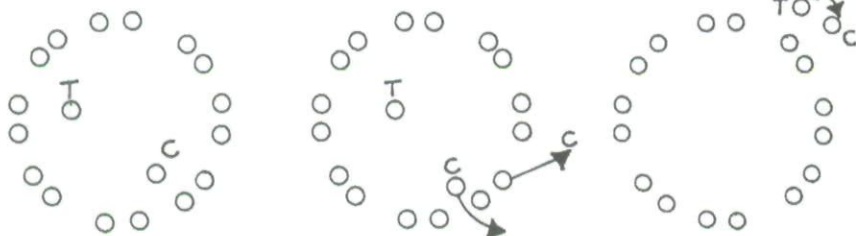
Focus: develop quickness and reaction time

1. Designate one fox and one squirrel.
2. Remaining children pair up and hold hands, facing each other with arms raised. They are designated as trees and spread out around the play area.
3. The fox chases and attempts to tag the squirrel. The squirrel can avoid being tagged by hiding in a tree. If the squirrel hides in a tree, the person facing the squirrel's back becomes the squirrel.
4. The game proceeds until each player has had a turn at being either the fox or the squirrel.

PARTNER TAG

Focus: quick reaction time and fast running around the circle

1. Designate one participant the tagger and one the first chasee. The remaining participants pair up and form a circle.



2. Tagger chases chasee. If tagger tags chasee, they reverse their roles.

3. If chasee joins a pair before being tagged, the outside pair member is now chasee.

4. If tagger begins to tire, instructor designates a new tagger.

OCTOPUS TAG

Focus: reaction time and high speed with changes of direction

1. Form a large group, with 20 to 30 participants. Designate one or two people as octopus. The remaining participants line up against one wall.
2. Octopus yell "Octopus," and participants run to opposite wall.
3. If octopus tags a participant, participant turns around on one foot to help tag others.



ARM SWING DRILL

Focus: arm drive and coordination

1. Stand with feet parallel, six inches (15 centimeters) apart. Bend elbows at 90 degrees.
2. Without changing the position of the body and elbow angle, swing the arms forward and backward. Shoulders should be down and relaxed while swinging the hands up to the level of the face.



STANDING START DRILLS

Focus: quick acceleration from standing position

1. In many sports, especially team sports, the ability to accelerate quickly is desirable. Standing start drills, therefore, train athletes to quickly start a fast acceleration in a given direction.
2. Stand with feet apart in a ready position.
3. At the instructor's signal, the player attempts to quickly accelerate in the desired direction.

Variation

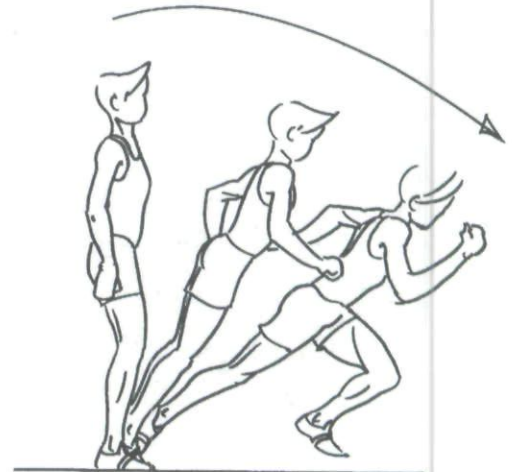
Perform same with turns around a cone or a series of turns or slalom around four or five cones.



FALLING START

Focus: quick acceleration from falling forward position

1. Begin standing.
2. At commands, "On your mark," the athlete moves to the start line.
3. "Set," one foot is back, opposite arm is forward, with both arms at 90-degree angles. The body weight should be about to tip over from a slightly forward leaning position.
4. "Go," swing forward arm back vigorously and back arm forward. Drive back leg through to make first stride.



QUICK STEPS



Focus: quick acceleration with short and quick steps

1. Take either of the previous starting positions.
2. Perform quick steps from the start for 10 to 15 meters or yards, always landing the front foot below the knee of the front leg. This will result in an acceleration with short and quick steps.

HIGH KNEES

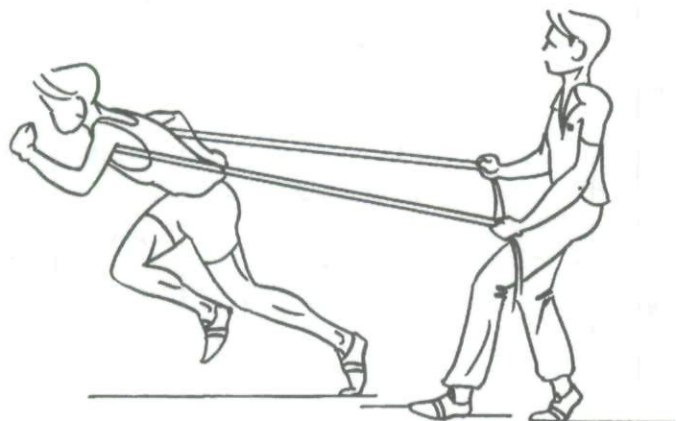


Focus: strengthens calves and hip flexors

1. Walk, driving the knee of the front leg above the horizontal, raising up on toes of the supporting leg.
2. Arms at 90 degrees drive back and forth in coordination with the legs.
3. Do repetitions of 20 to 25 meters or yards.

HARNESS RUNNING

Focus: arm drive, leg power development

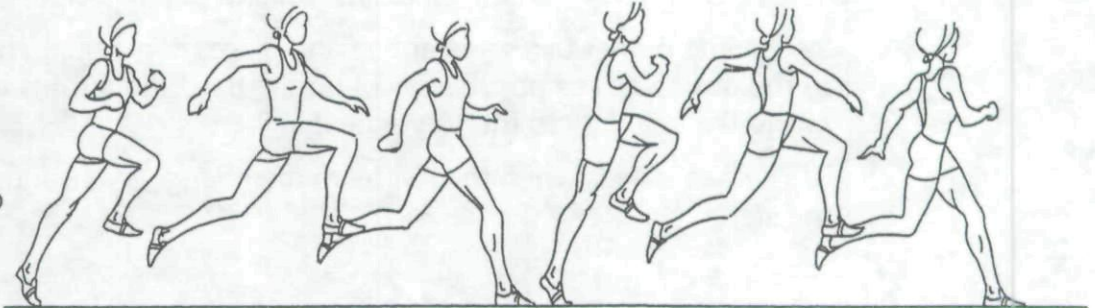


1. Place a rope or ribbon around the athlete's shoulders under the armpits (like a rucksack).
2. The instructor holds the ends of the rope and opposes the athlete's forward drive with a slight resistance.
3. To defeat the resistance, the athlete has to push forcefully against the ground, slightly inclining forward, and driving the knees forward powerfully.
4. Repeat for a 10- to 15-meter or yard run.

BIG STEPS

Focus: improve leg power and long strides

1. Begin standing.
2. Make 10 to 15 marks or circles on the ground at a distance that will force the athlete to perform big steps (strides).



3. Perform long strides to always place the feet in the circles and walk back to starting point.

ACCELERATION RUN

Focus: improve fast acceleration

1. Begin standing, one leg forward, in a ready position.
2. Repeat acceleration runs observing good form: running tall, coordinating arms and legs, arms bent, heels coming up to the buttocks, eyes forward, shoulders relaxed.



BEANBAG RELAY

Focus: acceleration, deceleration, leg power

1. Two teams line up facing each other, 65 feet (20 meters) (maximum) apart.
2. The front athlete from one team runs with the beanbag and hands it off to the front athlete of the other team, who becomes the next runner; then the first athlete sits at the back of the line.

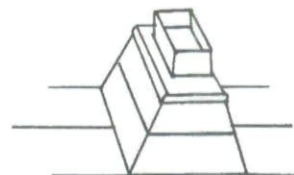
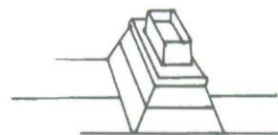
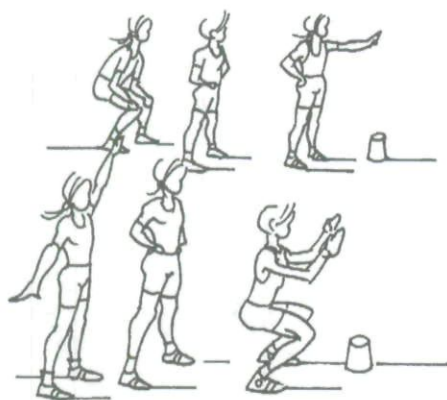
3. The relay ends when all members have run with the beanbag and are seated.



BEANBAG SHUTTLE

Focus: fast acceleration

1. A run and fetch game with teams running to pick beanbags out of a box.
2. The first runner takes a beanbag and places it in a box. The next player runs to the box as fast as possible, picks up the bag, and returns back to her team, giving the beanbag to the player next in line.
3. The game ends when the last team member gets a beanbag and returns to the start.



THE LOOP

Focus: start and fast run forward and around the loop

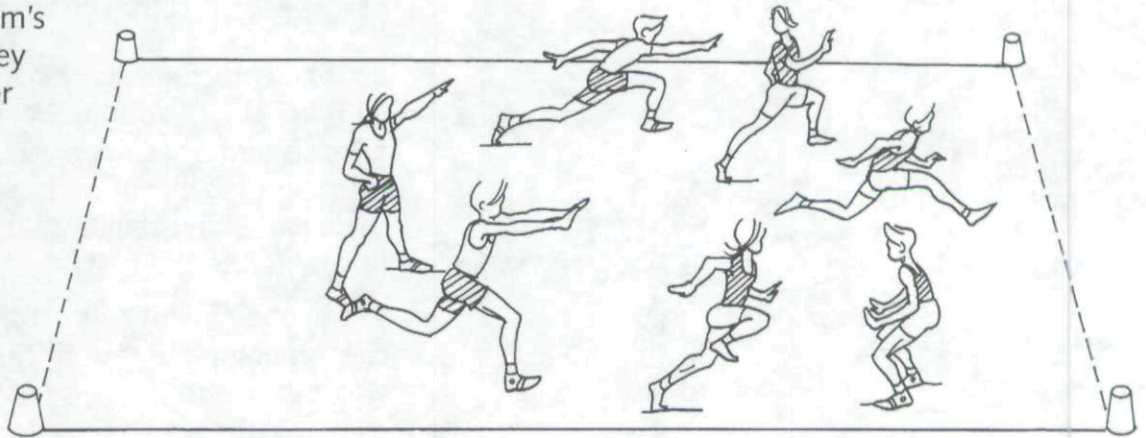
1. Divide the group into small teams of six or eight athletes. From a standing position, the athletes fall forward and start to run a loop around a cone.
2. Once around the cone they walk back rapidly.



RABBITS AND ROOSTERS

Focus: fast acceleration with quick changes of direction

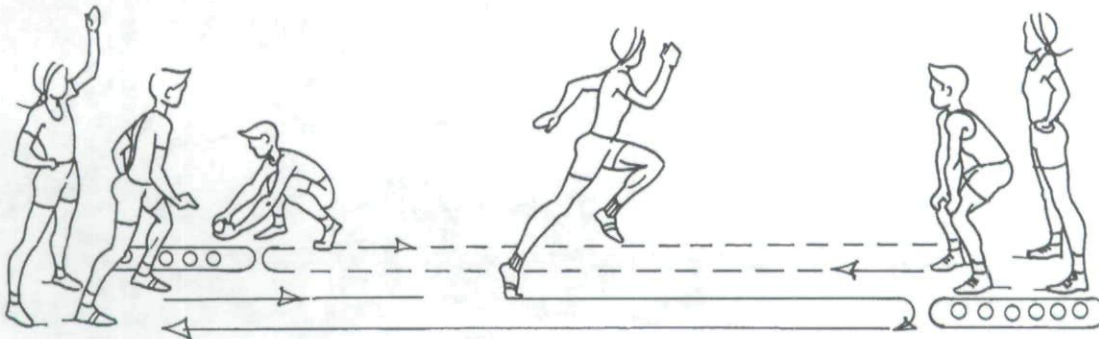
1. Two teams, four meters or yards apart, each with a three-meter or yard safety zone in front of their home wall.
2. Name one team Rabbits, the other Roosters.
3. Call one team's name, then they chase the other team to their safety zone.
4. Those tagged join the other team.



FINDERS KEEPERS

Focus: acceleration, deceleration, leg power

1. Divide the athletes into teams of four or five. Two teams 15 meters or yards apart stand to the right and behind their home hoop, which has four beanbags or balls.
2. The object is to have six beanbags in the home hoop.
3. At the start command, the first runner runs to the opposing team's hoop, finds any one of the available beanbags, picks it up, returns to the home hoop, and drops it.
4. Once the beanbag hits the floor, the second team member goes to find a beanbag in the other team's hoop.
5. End the round when a team has six bean bags.



TENTS AND CAMPERS



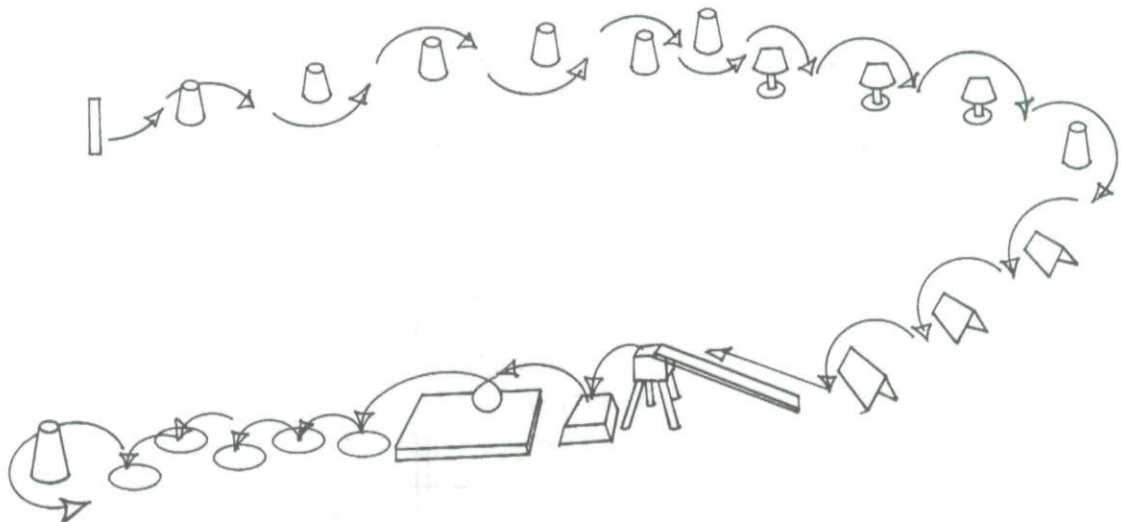
Focus: reaction time and acceleration

1. Athletes pair off and form one or more circles 15 to 20 meters or yards in diameter. Within each pair is a tent who stands with feet apart and a camper who sits in front of the tent.
2. The instructor calls words that begin with "t" or "c" sounds. When the instructor calls tent or camper, the appropriate member of each pair runs around the circle and either stands behind the camper or crawls into the tent.
3. Anyone moving when the instructor calls anything but tent or camper has to wait out one run.

OBSTACLE COURSE

Focus: improve leg power and run around and over obstacles

1. Set a slalom course with benches to step over, hoops to step in, mats for front rolling, and saddle horses or boxes for ducking under or climbing over.
2. Start with a walk-through and increase speed as capability increases. Leave enough room between athletes on the course (especially in doing front rolls).

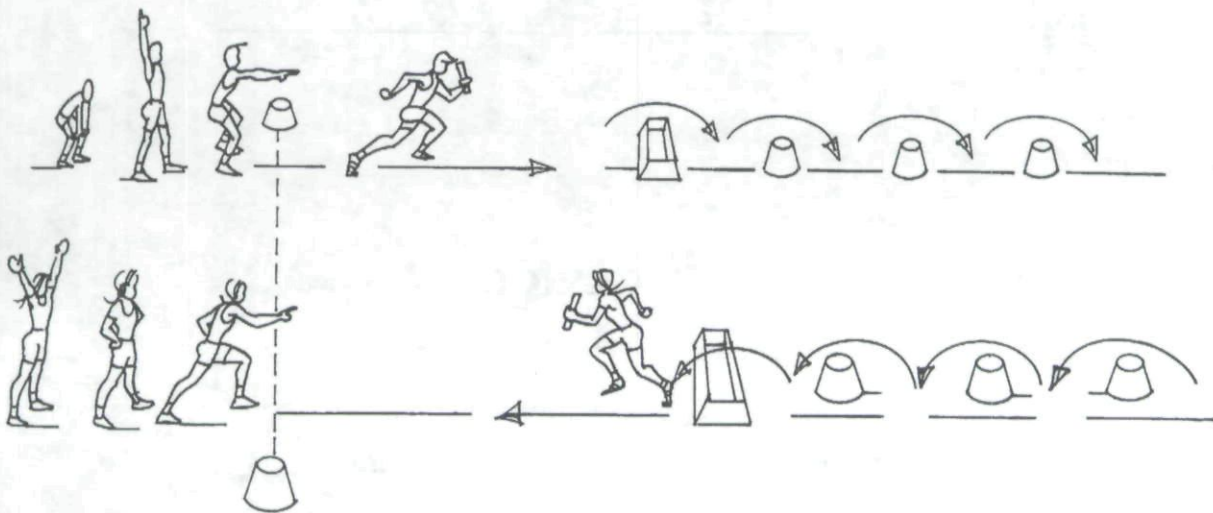


LOW OBSTACLE RELAY

Focus: acceleration and leg power

1. Set out one or more straight courses with a cone as a turnaround point. (The fewer athletes per course the better.)
2. The course should have low obstacles that athletes can run over, not leap or hop over.
3. Placing the obstacles close together encourages quick steps, and placing them farther apart encourages longer or more steps.
4. Have the athletes run the course with two steps between the obstacles; then spread them out and run it again with three or four steps between. Hurdle rhythm involves landing plus three steps between objects, like dot-dash-dash-dash in Morse code.

Note: The scope of these exercises is to improve quick footwork, which is important in many team sports.



FORWARD CROSSOVER

Focus: quick leg action and agility

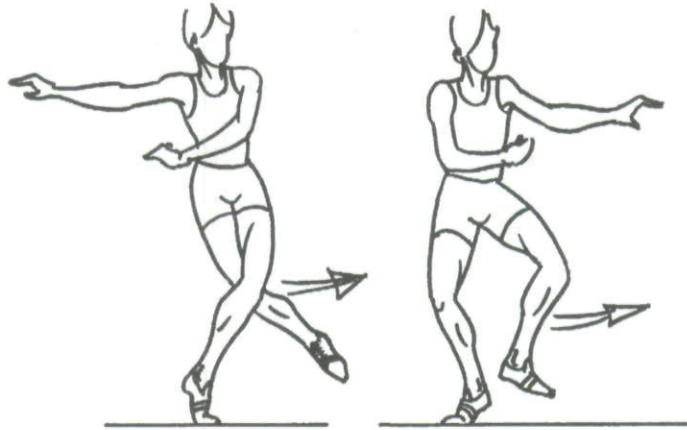
1. Moving left, right leg crosses in front of left leg for 10 meters or yards in each direction.
2. Repeat.



BACKWARD CROSSOVER

Focus: quick leg action and agility

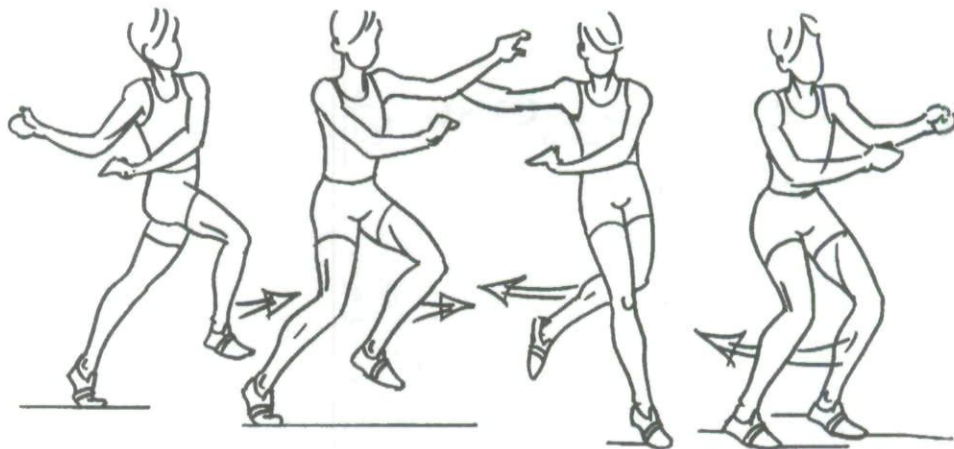
1. Moving left, right leg crosses behind left leg for five to eight meters or yards.
2. Repeat.



CARIOCA

Focus: agility and quick feet

1. Moving sideways, facing one way, forward crossover, backward crossover.
2. Repeat in both directions for 8 to 10 meters or yards.

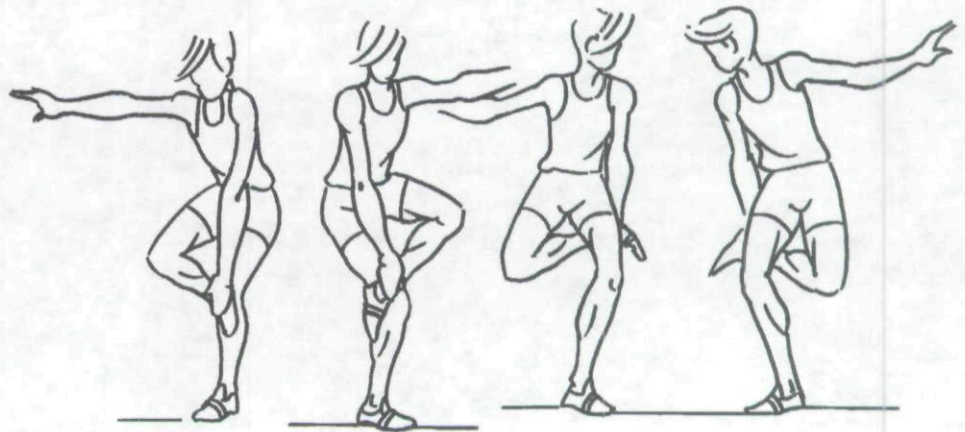


FOOT TOUCHES

Focus: quick footwork and agility

1. Touch left hand to right heel in front of the body, then right hand to left heel in front of the body, then left hand to right heel behind the body, then right hand to left heel behind the body.

2. Repeat as quickly as possible.



Note: Simple reaction time training should be part of most activities the children perform. Their ability to react to the demands of play will result in a reaction time training effect.

GO, GO, GO, STOP

Focus: reaction time, acceleration, and deceleration

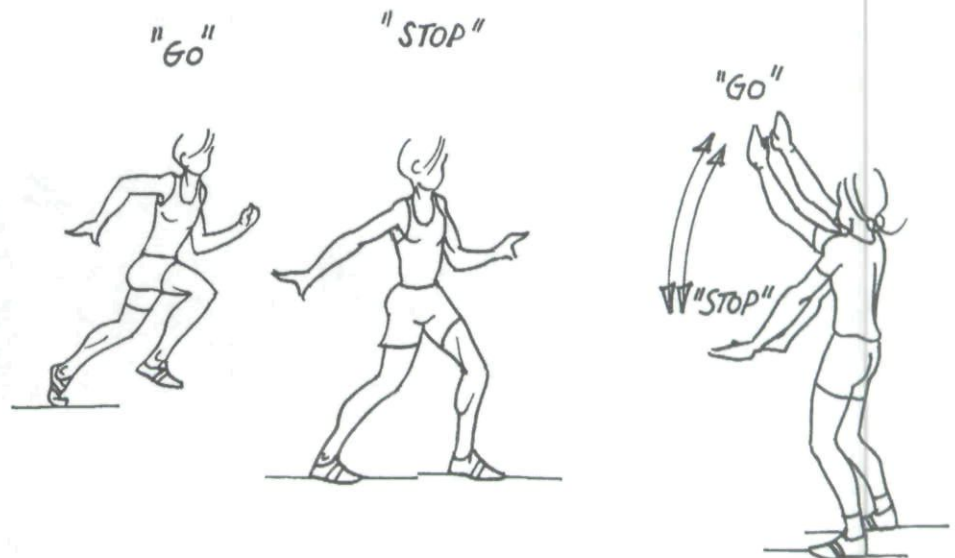
1. An athlete stands 10 meters or yards ahead of remaining participants, facing away from the group.

2. This person calls out "Go" as many times as he or she likes, then "Stop."

3. At "Go," the runners run toward the caller, and at "Stop," they freeze on the spot.

4. The caller turns to see if anyone is still moving.

5. The last person caught moving becomes the caller for the next round.



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