

# Strength Training in Children and Teens: Implementing Safe, Effective & Fun Programs—Part Two

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## Learning Objective

To learn how to develop and implement a safe, effective, and fun strength training program for youth.

**Key Words:** *Weight Training, Resistance Training, Muscle Hypertrophy.*

## When Is a Child Ready to Begin Strength Training?

Parents frequently ask at what age their children can start strength training. It should be noted that our nation has health objectives (1) that strive to increase the number of children aged six years and older who regularly participate in physical activities that enhance and maintain muscular fitness. Children can increase strength as part of normal household and yard chores, games, playing at the park, and climbing ropes and jungle gyms. There is no predefined age at which children can begin to participate in a well-organized and supervised strength training program (2, 3). At a minimum, all participants should be able to accept and follow directions (2–6). Generally, if a child or adolescent is capable of participating in an organized youth sport, he or she is capable of participating in an individualized conditioning program designed to condition the body to meet the physical demands imposed by the sport (3–5, 7). A child or adolescent should begin strength training only if he or she believes it to be worthwhile and should be encouraged to continue participation only if the program is fun, challenging, and safe (8). Because many parents are uninformed about the risks, benefits, and expectations of participating in a youth strength training program, the health/fitness professional can help parents to make informed decisions as to the readiness of their children.

Some organizations (2, 6–8) suggest that all participants should have a medical examination by a physician knowledgeable in sports medicine before participating in strength training. For apparently healthy children and adolescents, a preparticipation medical exam is desirable but not mandatory (3, 4). A preparticipation physical exam

should be required of participants with known or suspected conditions that require treatment or may exclude or limit their participation (3).

## Getting Started

Knowing that the social aspects of a strength training program are important to youth, the fitness professional can



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consider the following when starting a youth strength training program:

- Organize the participants into age groups such as 5 to 7, 8 to 11, and 12 and over. Don't mix younger children with adolescents.
- Choose creative and fun names for youth programs and/or each age group.
- Consider the local school schedule when organizing a strength training program.
- Depending upon available facilities, classes can begin and end with a fun, noncompetitive recreational activity or game such as basketball, swimming, martial arts, mini-Olympics, rock climbing, or fitness challenge courses. This exposes youth to a wide variety of activities and emphasizes the development of all of the components of physical fitness.
- Avoid competition among the children in the weight room. Instead, encourage self-improvement and individual accomplishments.
- Provide rewards for participation, attendance, and achievement of personal goals.

- Use educational objectives as the basis for a competency-based advancement system. Much like certified trainers must demonstrate knowledge, skill, and abilities in various areas, the health/fitness professional can require participants to demonstrate competency in identifying muscle groups and their actions, safety, weight room etiquette, spotting techniques, identifying weight machines by name and function, and injury prevention before advancing to the next level. Each level represents a higher rank of knowledge and skills. The martial arts follow this method of advancement, as do the Boy Scouts and Girl Scouts of America.

### Forming an Alliance with Parents and Coaches

Ultimately, parents decide which programs their children participate in. Parents attach importance to the values that can be instilled in their children through youth sports programs. Health/fitness professionals can promote similar values to parents: acquisition of additional motor skills, learning to function as a team, practicing good sportsmanship, and developing self-discipline, responsibility, self-esteem, and leadership. A well-organized and supervised strength training program provides children an opportunity to follow rules that are designed to maximize safety and enjoyment. In addition, participants benefit from a program with educational objectives. Health/fitness professionals also can form partnerships with local youth sports programs or individual team coaches to provide strength and conditioning programs. Coaches of team sports may be some of the best advocates for well-organized strength and conditioning programs. The information in Part 1 of this article as well as the information that follows can be used to address any concerns and misconceptions held by some parents and coaches. Here are some value-driven ideas that can be used to promote a strength training program.





- Participation in a sport is not the sole means to improve physical fitness. Ideally, physical fitness should be improved to participate effectively, safely, and enjoyably in recreation and sports. Participation in recreational and sports activities may evolve from or occur concurrently with participation in youth fitness programs.
- Strength training is one important component of an overall conditioning program that aims to develop all of the elements of physical fitness (2). The development of strength should complement and not neglect other components of physical fitness. A significant benefit of strength training may be its ability to better prepare young participants for the demands of recreational and sport participation, enabling them to be more successful.
- A youth fitness program that includes strength training should be fun, safe, effective, and educational. A primary emphasis of the program is to teach the skills and lifting technique (including breathing patterns) required to perform the exercise properly and safely. All activities in the program are to be supervised.
- Each participant should understand the program objectives and be willing to follow the rules and participate with the intention of improving overall physical fitness, achieving specific benefits, and having fun.

### Training Methods

The youth strength training programs should not rely on one form of strength training, such as weight training (2, 3, 7). Programs should be designed to include and encourage participation in a variety of physical activities and training methods rather than “specializing” in one sport or one training method. Different modes of strength training, including weight machines, free weights, body weight exercises, rubber tubing, and medicine balls can and should be used in strength training programs for youth. Strength training equipment should be appropriate for the age group and should fit the child. Young or small children should not use machines designed for adults. Many older adolescents can safely fit into and use adult-sized machines. Children who attempt exercises in machines designed for adults will not have proper body alignment and support, making the exercise less effective and potentially unsafe. Weight increments on adult machines are typically too large for children and adolescents. If child-sized machines are not available, exercises using body weight as the resistance or free weights can be used. Bar dips, pull-ups, or push-ups can be integrated into an exercise session, circuit, or a fitness course. Body weight exercises should not be used when working with sedentary or obese children who may not have the strength to successfully perform the exercise. The health/fitness professional must be able to develop strength training routines so that each individual can have successful experiences. For this reason, use of free weights, machines, or rubber tubing is advantageous.

Free weights are a viable alternative if child-sized machines are not available. Free weights also are an alternative for obese children who have difficulty getting in and out of machines. Use of free weights should be closely supervised after proper technique has been demonstrated. Lightweight Olympic style bars can be used to learn proper technique and the correct movement pattern.

Medicine balls of various sizes can be used to develop upper-body and core strength. Participants can work with a partner to perform rotational and diagonal movements to strengthen the core. To develop the upper body, participants can toss the ball back and forth using a two-handed overhead toss or two-handed chest pass. For advanced youth, medicine balls can be used instead of weights to increase the resistance in doing abdominal exercises. One or two medicine balls can be used to do close grip or regular push-ups.

Rubber tubing can be used by many young children or those who are not ready to use free weights or machines. Because the resistance increases further into the range of motion, participants should be encouraged to use a full range of motion and maintain proper body alignment. As

do all forms of exercise, use of rubber tubing carries some inherent risk. Use of rubber tubing with grips may reduce the risk of injury that could occur if a participant were to let go of the tubing.

It is common for youth to focus their training efforts on a limited number of areas of the body (*e.g.*, chest or arms) and little or no time training the body's core (*e.g.*, abdomen, hips, and lower back). Because of the potential for lower-back injuries during strength training, exercises that strengthen the core should be included in any training program (5, 8). Core exercises ought to include unidirectional exercises such as curl-ups, crunches, and back extensions as well as multidirectional exercises such as seated or standing rotational movements with a medicine ball.

### Specificity of Strength Training

The principle of specificity states that a training stimulus (overload) must be effectively applied to a specific physiological system for the expected adaptations to occur. Training adaptations are specific to the type and mode of training as well as the nature of the overload. Athletic performance is optimized by matching the sport-specific metabolic demands, joint velocities, and angular movements with the strength training program (3). A well-rounded strength training program can meet the needs of the vast majority of children and adolescents. For adolescents interested in strength training for athletic purposes, a general strength training program is still recommended.

### Overload of Strength Training

For an adaptation (training effect) to occur, the overload must be greater than that to which the individual is normally accustomed. A strength training overload is applied through the choice and order of exercises, rest periods, load, sets, repetitions, and frequency of training.

A strength training session should include at least 5 to 10 minutes of general warm-up exercises including low-intensity aerobic exercise and stretching (4). Warm-up sets using light to moderate loads should be included for each exercise. Exercises should be performed through a full functional range of motion to develop strength through the full range and prevent loss of flexibility (4, 6, 8–10). The exceptions include exercises that result in extreme ranges of motion or undue stress on joint capsules. Examples include bar dips and full arc supine dumbbell flies. These exercises should be completed in a limited range of motion. Leg presses should begin in the extended position.

Rest refers to the amount of rest between sets and between exercise sessions. The length of rest periods

between sets contributes to the overall overload because shorter rest periods decrease the recovery of energy producing metabolic pathways and affect performance on subsequent sets. Full recovery between sets may take several minutes, but the health/fitness professional can expect that most children and adolescents have difficulty resting more than one to two minutes between sets. Working in small groups of two to three participants can help participants get adequate rest between sets without becoming bored.

Each participant should begin a strength training program at a level corresponding with his or her personal physical abilities. If the volume or intensity is too high, the health/fitness professional may put the participant at increased risk of injury and reduce the enjoyment of the strength training experience. Follow the guidelines listed for overload and progression. Introduce proper lifting technique (*i.e.*, controlled movements and breathing) and weight room conduct as soon as possible after a participant enters the program and begins strength training. Learning and using good training habits reduces the risk of injury (2, 4). Use no-load repetitions when initially learning new movement patterns and exercises (3, 4, 8) to help develop balance and control. Once basic movement and breathing patterns are established, use sets of relatively light loads to further establish coordination of movement patterns. Progression from no-load to light-load sets exposes the muscle groups to new learning experiences. While the participant is still mastering the movement patterns, it is critical that sets do not result in fatigue because fatigue would hinder the learning of correct technique. Therefore, although a load that permits 12 to 15 reps is used, not all of the repetitions need to be performed.

Once movement patterns are established, most sets should be performed at loads permitting 6 to 15 repetitions



(2, 4). Participants can begin this phase of their training program with one to two sets of six to eight exercises that train the major muscle groups with appropriate balance across joints (*i.e.*, flexors and extensors) as well as upper- and lower-body muscle groups. Strength training two to three days per week is recommended for children and adolescents (2, 4). During periods of accelerated growth (adolescent growth spurt), there is an increased risk of injury, so the health/fitness professional can decrease the volume and intensity of training until the participant has passed his or her period of accelerated growth (5, 7).

When both single- and multiple-joint exercises are performed for any given muscle group in the same exercise session, multiple-joint exercises should be performed first, followed by single-joint exercises. Exercises that target large muscle groups should be performed before exercises that target small muscle groups. Exercises requiring complex movements should be performed before exercises requiring less complex movements. The purpose of performing multiple-joint, large-muscle mass, complex movements before single-joint, small-muscle mass, simple movements is threefold: 1) to prevent training plateaus, 2) to increase training efficiency, and 3) to decrease injury potential. Participants should not be allowed to perform more complex parts of an exercise or perform new exercises until less complex exercises or parts of an exercise are mastered (2, 8).

### Lifting Maximal Amounts of Weight

Until recently, there have been various opinions offered on whether children and adolescents should use maximal amounts of weight. In 1985, the National Strength and Conditioning Association (NSCA) recommended that children should never attempt maximal lifts before puberty (2). In 1990, the American Academy of Pediatrics recommended that youth should avoid the repetitive use of maximal weights until they have passed the age of maximal height velocity (9). This is, on average, age 15 for both genders (9). In 1993, ACSM (7) recommended that strength training programs for children and growing adolescents should exclude lifting maximal amounts of weight.

However, current research supports the opinion that one-repetition maximum lifts (1-RM) can be used to evaluate the effectiveness of a strength training program. The 1-RM must be supervised and performed correctly following an adequate progression of loading. This rationale is supported by current research (11) that reported that 96 boys and girls between the ages of 6 and 12 years old completed supervised 1-RM strength testing on an upper-body and lower-body exercise without injury. There is no support for the chronic use of maximum resistance training because

of the risk of injury. Participants who continually want to lift maximal weights should be redirected towards the development of proper form and technique using submaximal loads on a variety of strength exercises (5). An alternative approach to assessing strength is to perform a 10-RM set.

### Progression of a Youth Strength Training Program

Because serious injury is possible if proper guidelines are not followed (3, 4), close attention should be given to any related pain and injury. Pain during an exercise precludes continuation of that exercise. Pain following an exercise, including the next day, precludes performing the exercise during the next exercise session (8). Symptoms that persist longer than two days merit medical evaluation.

Over time, the overload training stimulus needs to be increased to assure continued adaptation. Progression of a strength training program includes increasing the total overload of the program as well as developing the motor skills required (8). Single-set protocols often are completed in the first several weeks of training when skill development and conditioning are low. Participants should be given ample time to develop and correctly demonstrate proper training technique. Total overload can be changed by manipulating the resistance, number of exercises per muscle group, number of sets, and the number of repetitions. Increasing the number of different exercises performed per muscle group introduces new motor learning experiences, activates the muscle in new movement patterns and ranges of motion, adds variety to a program, and emphasizes the overall conditioning of the body rather than developing strength in one exercise. Addition of different exercises per muscle group should include both single-joint and multiple-joint exercises. Multiple-joint exercises develop neuromuscular coordination and skill technique (4) and require more balance and stabilization (5).

The resistance (load) should be increased gradually as strength improves. Resistance can be increased when the desired number of repetitions can be performed (5), when a set of 20 repetitions becomes “easy” (8), or when the participant can complete three sets of 20 repetitions (8). In these examples, increases of resistance in increments of 5% to 10% are appropriate (4). An alternative approach (6) to increasing resistance requires the participant to select a weight at which he or she can perform the fewest number of repetitions (*i.e.*, 10) in the desired range (*i.e.*, 10 to 15 reps). When the participant can perform 15 repetitions at the same weight in good form, the resistance can be increased so that he or she can only perform 10 repetitions. Sets should be completed to the point of fatigue, not failure (8). Fatigue is

defined as the participant's perception that the repetitions are too difficult or that proper form is being compromised (8). Failure is defined as the inability to complete the repetition. Progression to performing 2 to 3 exercises per muscle group for 1 to 3 sets of 10 to 15 repetitions performed 3 days per week (5, 8) or 3 to 4 sets of 6 to 8 repetitions (10) has been recommended.

### Conclusion

Health/fitness professionals can implement strength training programs for youth to better serve their clientele and community. By following the ideas and recommendations discussed in this article, a qualified health/fitness professional can develop safe, effective, and successful strength training programs that are part of a well-rounded conditioning program for youth.



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### Condensed Version and Bottom Line

There have been several misconceptions about strength training in children and adolescents. Based upon the current literature, strength training in children and adolescents is safe and effective when health/fitness professionals appropriately apply knowledge of developmental physiology and adhere to the recommended guidelines of various health/fitness professional organizations.