RESISTANCE TRAINING FOR KIDS
Right from the Start
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Learning Objectives
1. Understand the importance of enhancing muscular fitness early in life.
2. Dispel the myths associated with youth resistance training.
3. Describe the PROCESS [Progression, Regularity, Overload, Creativity, Enjoyment, Socialization, and Supervision] of developing a youth resistance training program.

Key words: Children, Motor Skills, Strength Training, Physical Development, Youth Fitness

Global recommendations on youth physical activity suggest that children and adolescents should accumulate at least 60 minutes of moderate to vigorous physical activity (MVPA) daily in the context of family, school, and community activities (33). In addition to active games and aerobic exercise, regular participation in strength-building activities also should be incorporated into the weekly routine of school-aged youth (21,33). Despite traditional fears and misinformed concerns associated with youth resistance training, a compelling body of evidence has found that participation in a supervised resistance training program can be a safe, effective, and worthwhile method of conditioning for children and adolescents (5,14,21). Nowadays, a growing number of fitness centers and sport training clubs offer youth fitness programs that include various forms of resistance exercise.

Many of the benefits associated with adult resistance training programs are attainable by children and adolescents (21,29). However, youth resistance training programs should be supervised by qualified fitness professionals and consistent with the needs, interests, and abilities of younger populations. This is where the art of youth resistance training comes into play because the physical demands of training need to be balanced with effective instructional strategies that maximize enjoyment, foster socialization, and spark an ongoing interest in daily MVPA. That is, the most effective youth fitness professionals are able to use different pedagogical approaches to address individual learning styles and developmental needs. Notwithstanding the importance of improving muscular fitness (i.e., muscular strength, muscular power, and muscular endurance), youth fitness professionals should provide an opportunity for all participants to have fun, make friends, and learn something new.

In this article, a review of troubling trends in muscular fitness among modern-day youth will highlight the need for planned resistance training early in life. Myths associated with youth resistance training will be addressed and the potential benefits of integrating strength-building exercises into youth fitness programs will be discussed. Ideas for enhancing resistance training skill competency will provide fitness professionals with information that can be used to design training programs that are safe, effective, and progressive. For
ease of discussion, the terms youth and young athletes refer to both children and adolescents.

**TROUBLING TRENDS IN MUSCULAR FITNESS**

Although the enduring impact of daily MVPA on the health and well-being of youth continues to be advanced in the literature (33), these benefits will be realized only if youth have developed adequate levels of muscular fitness and movement skill competency (4,6,16). A certain level of force production and force attenuation is needed to perform movement skills, and therefore, the importance of enhancing muscular fitness should be considered foundational to long-term physical development (12,20). Youth who do not become proficient movers early in life will be less likely to participate in diverse physical activities as adults (27,30). This idea relates to Seefeldt’s original notion of a proficiency barrier whereby children who do not surpass a critical threshold of motor skill proficiency early in life will be less likely to engage in sports and physical activities later in life (28). Just like the skills of reading and writing, interest and aptitude in physical activity should begin early in life with a strong focus on movement skills and physical abilities.

Epidemiological findings from an international sample of children indicate that a growing number of youth are not meeting physical activity recommendations (31), and those with lower levels of MVPA are at increased risk of obesity (18). Without opportunities to develop the prerequisite levels of muscular fitness and motor skill proficiency early in life, youth are less likely to participate in games and activities with confidence and vigor later in life (16,22). Secular trends in measures of muscular fitness in English children indicate declines in bent arm hang, sit-up performance, and hand grip strength during a 10-year period (7). Similar observations were reported in selected measures of muscular power (e.g., long jump and vertical jump) in Spanish adolescents (23) and fundamental movement skills (e.g., jumping and kicking) in Australian youth (17). Although many factors influence time spent in MVPA during the growing years (18), the global pandemic of physical inactivity may be due, at least in part, to a deficiency of muscular fitness and motor skill performance in modern-day youth.

In support of this view a 2-year study of children between 6 and 10 years of age found that those with low motor competency participated less in sports and had fewer opportunities for developing motor abilities and physical fitness (16). Other researchers noted an increasingly widening gap in gross motor coordination between normal-weight and overweight children (10). Unfortunately, the divergence in performance between children with low and high levels of muscular fitness seems to persist across developmental time in the absence of targeted interventions. Without regular opportunities to enhance their muscular strength and motor skill abilities early in life, youth will be less likely to engage in the recommended amount of daily MVPA and more likely to experience negative health outcomes (12). Of note, recent increases in the waist circumference of adolescents during periods of bodyweight stabilization suggest that modern-day youth have more fat and less muscle than previous generations (15).

**TRAIN THE DEVELOPING BRAIN**

The first few years of life are characterized by rapid changes in the myelination of the central nervous system, and the effects of a well-designed resistance training program can be long lasting (24). Similar to learning a new language or playing a musical instrument, there is a unique opportunity to target strength development early in life to set the stage for greater gains in physical fitness later in life. Research findings indicate that children show greater training-induced gains in various motor performance skills (e.g., jumping, running, and throwing) after resistance training than adolescents (4). Furthermore, training programs that target sports-related injuries to the anterior cruciate ligament are more effective if they start earlier in life before the onset of neuromuscular deficits that may increase injury risk (25). Collectively, these observations underscore a potential synergist adaptation whereby participation in strength-building activities early in life compliments naturally occurring changes in muscular fitness (11).

New insights into the design of long-term physical development programs have highlighted the importance of enhancing muscular strength during childhood and continuing participation in resistance training activities throughout adolescence (12,20,21). Indeed, resistance training should be a priority in youth fitness programs because muscular strength is the driving force toward performance enhancement and injury prevention (11,21). Although the need for individualization should not be overlooked when designing programs for youth of different sex, maturity status, and training experience, the formation of a long-term plan that maximizes strength development is critical for the promotion of daily physical activity as an ongoing lifestyle choice. As such, the concept of long-term physical development should be viewed as a structured, progressive, and informed approach for enhancing health, fitness, and performance in children and adolescents (20).

Years ago, some observers had concerns that resistance training would be unsafe or ineffective for youth (see side bar). However, a compelling body of research indicates that a systematic approach to long-term physical development grounded in resistance training offers observable health and fitness value to children and adolescents (21,29). In addition to enhancing muscular fitness and motor skill performance, various forms of resistance training can increase bone mineral density, improve cardiovascular risk factors, facilitate weight control, and improve inactive youth for the demands of physical activity and sport (11,21,29). The American College of Sports Medicine suggests that in the early stages of an exercise program, muscle-strengthening exercises may need to precede aerobic training activities in frail seniors (1). In the same light, targeted interventions that include strength-building exercises and directed-movement practice may be needed to activate inactive youth right from the start.
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Sidebar: Myths That Won’t Quit

Myth: Resistance training will stunt the growth of children

No scientific evidence indicates that participation in a supervised resistance training program will stunt the growth of children or damage developing growth plates (21). Childhood may actually be the opportune time to engage in weight-bearing activities that enhance bone mineral content and density (3). In all likelihood, regular participation in a well-designed resistance training program during the growing years will have a favorable influence on bone growth and development.

Myth: Resistance training is unsafe for children

The risks associated with youth resistance training are not greater than other recreational and sport activities in which youth regularly participate (14,21). Although accidents can happen, the key is to provide qualified instruction in a safe training environment and sensibly progress the program based on resistance training skill competency. In addition, basic education on weight training room etiquette, individual goals, and realistic outcomes should be part of youth resistance training programs.

Myth: Youth need to be at least 12 years old to life weights

Although there is no evidence-based minimum age for participation in a youth resistance training program, all participants should be able to accept directions and follow safety rules. Boys and girls younger than 12 years old have participated safely in supervised resistance training programs (14). Generally, when youth are ready for sport participation, approximately ages 7 or 8, they are ready for some type of resistance training as part of a well-rounded fitness program.

Myth: Girls will develop bulky muscles if they lift weights

Training-induced gains in muscular strength during childhood are primarily due to neuromuscular adaptations and skill development. Although boys may develop bigger muscles during the growing years because the effects of anabolic hormones would be operant, girls can get stronger throughout childhood and adolescence while gaining all the benefits from resistance training without developing bulky muscles (21).

Myth: Resistance training is only for young athletes

Regular participation in a well-designed resistance training program offers observable health and fitness value for all children and adolescents (21). In addition to performance enhancement and injury reduction, resistance training can improve musculoskeletal health, enhance metabolic function, and increase daily physical activity. Resistance training may be particularly beneficial for overweight youth who often are unwilling and unable to perform prolonged periods of aerobic exercise (29).

LEARN TO MOVE

Education and instruction on proper resistance training techniques and procedures should begin early in life to optimize training adaptations and spark an ongoing interest in resistance exercise. Although there is no minimum age for participation in a supervised resistance training program, most healthy 7- and 8-year-olds are ready to follow instructions and adhere to safety rules (11). Well-designed resistance training programs provide a needed opportunity for boys and girls to enhance their muscular fitness while improving their resistance training skill competency (RTSC). The construct of RTSC refers to the technical ability of performing a resistance exercise and involves the evaluation of movement patterns that are considered essential for the mastery of a particular exercise (2). Notwithstanding the importance of prescribing the right dose (i.e., intensity and volume) of resistance training, it is equally important to provide meaningful feedback on the quality of the exercise performance. Consequently, RTSC relates to one’s physical development as well as one’s ability to focus, follow instructions, and execute a task properly.

To improve RTSC, fitness professionals should provide consistent feedback on the technical performance of every exercise. Because most youth have limited experience in resistance training, the importance of assessing exercise technique using accepted commonalities of resistance exercise performance should not be overlooked. The perception of RTSC as opposed to the amount of weight lifted may help to reinforce the importance of maintaining proper exercise technique and illustrates the significance of movement pattern efficiency as the criterion measure (13). In addition, by assessing performance and recording component scores, fitness professionals can identify skills that need more instructional time, and youth can monitor their own progress as they work toward clearly defined goals.

An example of an RTSC checklist for the back squat exercise is outlined in the Table. During training sessions, youth are given specific feedback related to their technical performance and general demeanor. Consequently, they become aware of their strengths and weaknesses and address areas in need of improvement. The four levels used to assess RTSC performance are advanced (3 points), basic (2 points), capable (1 point), and developing (0 point). The advanced level is indicative of skilled lifting performance and a genuine interest in improving personal fitness. The developing level indicates that the participant performed a skill improperly or displayed behavior that was disrespectful or uncooperative. By recording the component scores and tallying up the total points for all phases of a specific exercise, fitness professionals can identify skills that need
more instructional time and effort. The back squat RTSC checklist can be used as a framework for developing rubrics for other exercises.

The ability to perform multijoint resistance exercises with proper technique requires adequate levels of muscular strength along with the coordinated integration of different physical, emotional, and cognitive abilities that evolve during the growing years (24). With regular exposure to resistance training early in life, children will have an opportunity to enhance their RTSC and muscular strength on a variety of exercises. Although youth with poor muscular strength and low RTSC may have difficulty performing basic resistance exercises, those with higher levels of muscular strength and skill competency will be better prepared to learn more advanced skills because they can use developing pathways that influence motor control and movement proficiency (11, 24).

If qualified fitness professionals assess movement mechanics and provide constructive feedback during training sessions, youth will have a unique opportunity to learn task-related activities and enhance their RTSC. If participants are beginners (low muscle strength and low RTSC), fitness professionals should prescribe a range of basic resistance exercises (e.g., squatting, pushing, or pulling movements) that enhance muscular strength while improving one’s competence to perform a variety of exercises. As youth gain competence and confidence in their ability to perform basic exercises, their capacity for resistance exercise can be improved with more advanced training programs (Figure 1). For technically competent youth with high levels of muscular strength, more advanced programs will be needed to optimize training adaptations (11, 19). An example of a youth resistance training program with exercise progressions will be provided in a future issue of ACSM’s Health & Fitness Journal®.

**TABLE: Back Squat Resistance Training Skill Competency Checklist**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Desired Action</th>
<th>Common Breakdown</th>
<th>Points*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check point</td>
<td>1. Safe exercise area</td>
<td>Inadequate space</td>
<td>Max 3</td>
</tr>
<tr>
<td></td>
<td>2. Correct starting weight</td>
<td>Incorrect weight selection</td>
<td>Earned 3</td>
</tr>
<tr>
<td></td>
<td>3. Collars on bar (if plates are used), and well-positioned safety rails</td>
<td>Lack of collars &amp; poorly positioned safety rails</td>
<td></td>
</tr>
<tr>
<td>Ready position</td>
<td>4. Bar on shoulders and upper back</td>
<td>Bar positioned on neck</td>
<td>Max 3</td>
</tr>
<tr>
<td></td>
<td>5. Head neutral &amp; eyes forward</td>
<td>Head facing downward</td>
<td>Earned 3</td>
</tr>
<tr>
<td></td>
<td>6. Feet wider than shoulder width</td>
<td>Feet position too narrow</td>
<td></td>
</tr>
<tr>
<td>Downward phase</td>
<td>7. Flex hips and knees</td>
<td>Thighs not at proper depth</td>
<td>Max 3</td>
</tr>
<tr>
<td></td>
<td>8. Thighs parallel to floor</td>
<td>Trunk begins to flex forward</td>
<td>Earned 3</td>
</tr>
<tr>
<td></td>
<td>9. Elbows under bar, knees over feet &amp; behind toes, torso erect, and feet flat</td>
<td>Knees inward or forward</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heels rise</td>
<td></td>
</tr>
<tr>
<td>Upward phase</td>
<td>10. Extend hips and knees</td>
<td>Trunk begins to round forward</td>
<td>Max 3</td>
</tr>
<tr>
<td></td>
<td>11. Torso upright, elbows under bar, knees over feet &amp; behind toes</td>
<td>Elbows drift behind bar, knees move inward/forward</td>
<td>Earned 3</td>
</tr>
<tr>
<td></td>
<td>12. Maintain bar control with firm grip until bar is racked</td>
<td>Firm grip is not maintained</td>
<td></td>
</tr>
<tr>
<td>General demeanor</td>
<td>13. Responsibility</td>
<td>Does not follow safety rules</td>
<td>Max 3</td>
</tr>
<tr>
<td></td>
<td>14. Resourcefulness</td>
<td>Unwilling to solve simple problems</td>
<td>Earned 3</td>
</tr>
<tr>
<td></td>
<td>15. Respect</td>
<td>Does not cooperate with others</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Points</td>
<td>Earned 15</td>
</tr>
</tbody>
</table>

The back squat resistance training skill competency checklist can be used to assess exercise performance and communicate the specific actions and behaviors that are required for this exercise.

*3 points, advanced; 2 points, basic; 1 point, capable; and 0 point, developing.

**UNDERSTAND THE PROCESS**

Youth resistance training programs need to be evidence-based and carefully prescribed to optimize training outcomes,
maximize exercise adherence, and reduce the risk of untoward events. Although factors such as heredity, training experience, and health habits (e.g., nutrition and sleep) will influence the rate and magnitude of adaptation that occurs, seven fundamental principles that determine the effectiveness of youth resistance training programs are the principles of (a) the Progression, (b) Regularity, (c) Overload, (d) Creativity, (e) Enjoyment, (f) Socialization, and (g) Supervision. These basic principles can be remembered as the PROCESS of youth resistance training. Although the principles of progression, regularity, and overload are well-established tenets of resistance training (26), the concepts of creativity, enjoyment, socialization, and supervision are particularly applicable to the design of sustainable youth fitness programs. When working with children and adolescents, it is important to remember that the goal of the program should not be limited to increasing muscular strength. Improving motor skills, fostering new social networks, and promoting healthy behaviors in a supportive environment are equally important. This is where the art and science of youth resistance training come into play because the principles of pediatric exercise science need to be balanced with effective teaching and ongoing instruction that is developmentally appropriate for children and adolescents.

**Principle of Progression**

The principle of progression refers to the fact that the demands placed on the growing body must be increased gradually through time to achieve long-term gains in muscular fitness. This does not mean that heavier weights should be used every workout, but rather, that through time, the stress placed on the body should progressively become more challenging to continually stimulate adaptations and maintain interest in the program. Without a more challenging stimulus that is consistent with each individual’s needs and abilities, additional training-induced adaptations are unlikely. Although increasing the training load or performing additional sets are common methods of progression, performing novel exercises or more complex movement patterns also are beneficial.

**Principle of Regularity**

Although the optimal resistance training frequency may depend on each participant’s training goals, two to three training sessions per week on nonconsecutive days are reasonable for most youth (21). Inconsistent training will result in only modest training adaptations, and periods of inactivity will result in a loss of muscular strength and power. The adage “use it or lose it” is appropriate for resistance exercise because training-induced adaptations in muscular fitness cannot be stored. The principle of regularity states that long-term gains in physical development will be realized only if the program is performed on a consistent basis throughout childhood and adolescence.

**Principle of Overload**

The overload principle is a fundamental tenet of all resistance training programs. The overload principle simply states that to enhance muscular fitness, the body must exercise at a level beyond that at which it is normally stressed. Otherwise, if the training stimulus is not increased beyond the level to which the muscles are accustomed, the participant will not maximize...
training adaptations. Training overload can be manipulated by changing the intensity, volume, frequency, or choice of exercise.

Principle of Creativity
The creativity principle refers to the imagination and ingenuity that can help to optimize training-induced adaptations and enhance exercise adherence. By sensibly incorporating novel exercises and new training equipment into the program, fitness professionals can help youth overcome barriers and maintain interest in resistance exercise. Creative thinking is particularly valuable when designing resistance training programs for youth with special needs or those with high levels of RTSC. The fundamental principles related to the prescription of sets and repetitions should be balanced with imagination and creativity. For example, youth can create new resistance exercises with lightweight medicine balls or find a solution on their own to a challenging task that requires balance and coordination.

Principle of Enjoyment
Enjoyment is an important determinant of participation in youth fitness and sport programs (32). The principle of enjoyment states that participants who enjoy the experience of participating in exercise or sports activities are more likely to adhere to the program and achieve training goals. Although encouragement from fitness professionals and support from family and friends can influence exercise adherence, the enjoyment a child feels during and after an exercise session can facilitate the sustainability of the desired sign. Enjoyment can be defined as a balance between skill and challenge (9). If the resistance training program is too advanced, youth may become anxious and lose interest. Conversely, if the training program is too easy, then youth may become bored. Youth resistance training programs should be matched with the physical abilities of the participants for the training experience to be enjoyable.

Principle of Socialization
Participation in a resistance training program can help youth interact with others in a positive and supportive manner. The principle of socialization states that gains in muscular fitness will be optimized if participants make new friends, meet other people, and work together toward a common goal. Participating in a resistance training program can help youth feel connected to other participants as they gain confidence and competence in their physical abilities and work toward a common goal. By paying more attention to the importance of socialization, fitness professionals will likely boost participants’ exercise performance and enjoyment of the training experience.

Principle of Supervision
The principle of supervision states that the safety and efficacy of exercise programs are maximized when qualified fitness professionals supervise activities and provide meaningful feedback throughout the training session. Not only does supervised resistance training reduce the risk of injury, but youth who participate in supervised resistance training programs are likely to make greater gains in muscular fitness (8). Indeed, qualified supervision is a critical component of any youth resistance training program, particularly for beginners who need to develop competence on basic exercises before progressing to more complex movements. Youth fitness specialists should be well versed in the principles of pediatric exercise science and should know how to teach, progress, and modify skill-based exercises (Figure 2).

SUMMARY
Troubling trends in muscular fitness among modern-day youth have created an immediate need to implement safe, effective, and enjoyable resistance training programs for children and adolescents. New insights into the design of long-term physical development programs have highlighted the importance of enhancing muscular fitness and resistance training skill competency early in life to set the stage for more advanced training later in life. Fitness professionals who genuinely appreciate the uniqueness of younger populations and who understand the PROCESS of youth resistance training are best prepared to design, supervise, and instruct sustainable programs that spark an ongoing interest in health and fitness.

Figure 2. Youth fitness professionals are most important in terms of education, motivation, socialization, and gratification.

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Recommended Reading:

- Faigenbaum AD, Westcott W. Youth Strength Training. Human Kinetics; Champaign (IL), 2009.


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BRIDGING THE GAP

Despite traditional fears and misinformed concerns associated with youth resistance training, new insights into the design of youth fitness programs have highlighted the importance of enhancing muscular fitness during childhood and continuing participation in strength-building activities throughout adolescence. Although factors such as heredity, training experience, and health habits (e.g., nutrition and sleep) will influence the rate and magnitude of adaptation, seven principles that determine the effectiveness of youth resistance training are the principles of (a) Progression, (b) Regularity, (c) Overload, (d) Creativity, (e) Enjoyment, (f) Socialization, and (g) Supervision. These basic principles can be remembered as the PROCESS of youth resistance training.

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