Some children and many adolescents use weights to increase strength or enlarge muscles. A smaller number compete in the sports of weight lifting, power lifting, and body building.

DEFINITIONS

Free weights are dumbbells and barbells that are used without the external support of a machine.

Major lifts are lifts used in the sports of weight and power lifting. Also used are the power clean and the incline and overhead presses. These lifts involve the use of free weights lifted through the extremes of joint motion in a ballistic rather than a controlled fashion. They have significant potential to cause injury. In the clean and jerk, the athlete lifts the barbell in a two-step movement from the floor to the chest and then over the head; the snatch involves the same movement of the barbell performed without interruption with a different technique. The power clean requires raising the barbell from the floor to the shoulders in a two-part maneuver. The dead lift is accomplished by raising the barbell from the floor by straightening the flexed knees. In the squat lift, the athlete holds the barbell behind the head on the shoulders, squats until the thighs are parallel with the floor, and then straightens the legs. In the bench press, the athlete lies supine on a bench, holds the barbell over the chest with the arms extended, lowers the weight to the chest, and then raises it again. The incline press is similar, except that the bench is at a 30° angle. In the overhead press, the lifter stands and raises the barbell from in front of the chest to over the head by extending the arms.

Strength training ("weight training," "resistance training") is the use of a variety of methods, including exercises with free weights and weight machines, to increase muscular strength, endurance, and/or power for sports participation or fitness enhancement.

Weight lifting and power lifting are competitive sports in which an athlete attempts to lift a maximal amount of free weight in specific lifts. In weight lifting, the lifts performed are the clean and jerk and the snatch. In power lifting, they are the squat lift, dead lift, and bench press.

Body building is a competitive sport in which the participant uses several resistance training methods, including free weights, to develop muscle size, symmetry, and definition.

STRENGTH TRAINING IN THE PREPUBESCENT ATHLETE

Recent research has shown that short-term programs in which prepubescent athletes are trained and supervised by knowledgeable adults can increase strength without significant injury risk. These studies did not evaluate the relationship between improved strength, injury prevention, or enhanced athletic performance. No data exist defining risks of injury in less well-organized programs.

STRENGTH TRAINING IN THE PUBESCENT AND POSTPUBESCENT ATHLETE

Interscholastic athletic programs in secondary schools are increasingly emphasizing strength training as a conditioning method for participants in male and female sports. The major lifts are often used.

Although the incidence is unknown, strength training in adolescence occasionally produces significant musculoskeletal injury, eg, epiphyseal fractures, ruptured intervertebral disks, and low back bony disruptions, especially during use of the major lifts. Safety requires careful planning of several
aspects of a program. This includes devising a program for the intensity, duration, frequency, and rate of progression of weight use, as well as selection of sport-specific exercises appropriate for the physical maturity of the individual. Proper supervision should be provided during training sessions.7-9

WEIGHT LIFTING, POWER LIFTING, AND BODY BUILDING

More than 600 teenagers are registered with the United States Weight Lifting Federation, and more than 3000 with the United States Power Lifting Federation. The limited available data indicate that these sports have a significant risk of injury. Brown and Kimball3 determined that 71 adolescent power lifters with a mean age of 16 years and a mean duration of 17 months participation sustained 98 musculoskeletal injuries, causing discontinuance of training for a total of 1126 days. Body building, with at least 8500 adolescent participants, uses some of the same exercises and presumably is associated with the same risks.

LIFTING MAXIMAL AMOUNTS OF WEIGHT

Because very little data are available on the relative rate of injury at different ages, controversy exists concerning when young athletes should be allowed to lift maximal amounts of weight. The United States Weight and Power Lifting Federations recommend the age of 14 years. Other experts suggest an older age, for example 16 years.7 Given the widely varying tempo of pubertal development among adolescents, a more appropriate guideline is one based on physical maturation. If male and female athletes have reached Tanner stage 5 in the development of their secondary sexual characteristics, they will have passed their period of maximal velocity of height growth,8,9 during which the epiphyses appear to be especially vulnerable to injury.10 This level of developmental maturity is reached at a mean age of approximately 15 years in both sexes, with much individual variation.10,11

TRAINING FOR COACHES

It is essential that coaches have training in supervising strength training programs. Adequate instruction may be obtained in collegiate or graduate school programs or from continuing education courses offered by college strength training instructors. A convenient training program of high quality is offered by the National Strength and Conditioning Association,8 with home study of written materials and videotapes followed by a certification examination.

REFERENCES

7. Fleck SJ, Kraemer WJ. Designing Resistance Training Pro-
grams. Champaign, IL: Human Kinetics Books; 1987
Strength Training, Weight and Power Lifting, and Body Building by Children and Adolescents

Pediatrics 1990;86;801

Updated Information & Services
including high resolution figures, can be found at:
http://pediatrics.aappublications.org/content/86/5/801

Permissions & Licensing
Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:
https://shop.aap.org/licensing-permissions/

Reprints
Information about ordering reprints can be found online:
http://classic.pediatrics.aappublications.org/content/reprints
Strength Training, Weight and Power Lifting, and Body Building by Children and Adolescents

*Pediatrics* 1990;86;801

The online version of this article, along with updated information and services, is located on the World Wide Web at:

http://pediatrics.aappublications.org/content/86/5/801