

STRENGTH DEVELOPMENT POSSIBILITIES FOR YOUNG ATHLETES

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The author outlines problems involved in the strength development of young athletes and provides recommendations of how to solve them by a correct choice of exercises, including several variations of circuits. The article is a summarized translation from the former German Democratic Republic's publication Der Leichtathlet. Re-printed with permission from Modern Athlete and Coach.

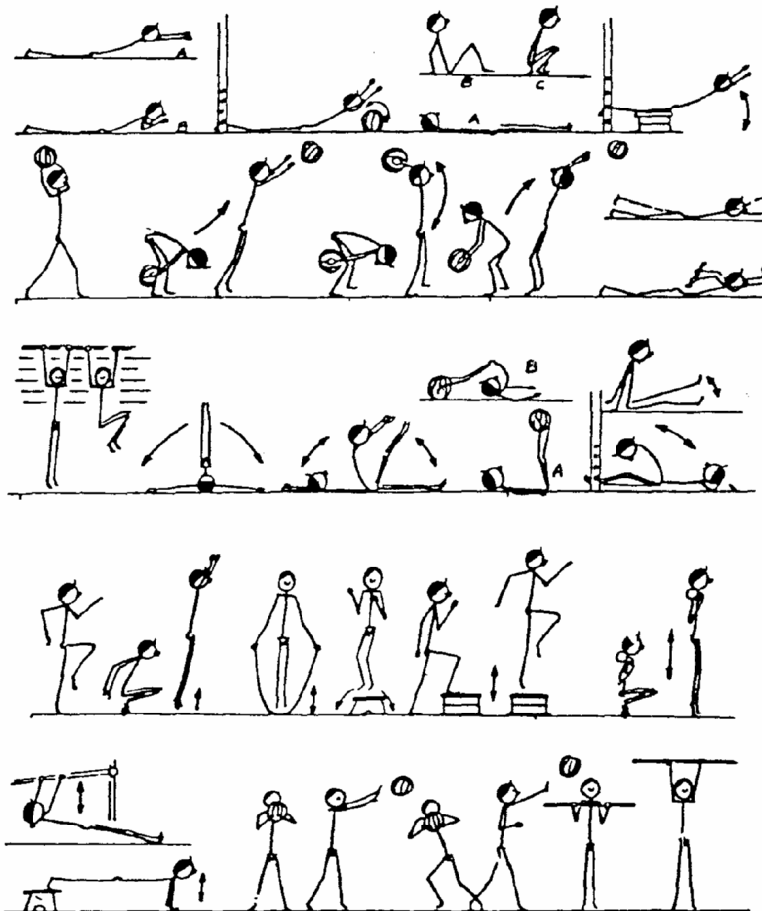
There has been little information available on the subject of strength development of young athletes. Consequently, the methods used in high performance sport are often employed in young athletes training with little or no adjustments. It appears therefore necessary to find concrete recommendations and practical solutions to establish specific methods suitable for the development of strength components (power, muscular endurance and maximal strength) of young performers.

The strength development of young athletes should be based on the established principles of basic training, aiming for a many-sided technical and physical development. Specific strength improvement to force the performance level of a particular event is not recommended. The development of strength must fit into the frame of the all-round training procedures and is not to be singled out for preferential attention. The aim should be for an all-round muscular development to prepare for higher training loads later.

With the exception of a few children with a very early growth acceleration, the development of general strength in the basic training phase in the 9 to 11 years age range can be approached in the same manner for boys and girls. However, differences between the two sexes are to be observed in the 11-13 up to 17-19 age range. Girls in this age range usually develop faster and stop growing earlier. They have a weaker support system and less skeletal muscle mass. Strength training should therefore be carried out with lighter loads than in the case of boys, who have a slower growth rate but a significant increase in muscle mass. The extended growth process of the boys allows them to continue longer with the basic training. In addition, they have a higher strength level and a significantly better rate of strength development.

There is a certain amount of uneven growth evident during the puberty years in the limbs, the trunk etc. This applies to both boys and girls. The influence of such deficiencies can be reduced by a systematic development of all-round strength.

At the same time, care should be taken to avoid risk factors, common to young athletes during the developmental stages of the bones, spine, tendons etc.



*SAMPLE STRENGTH DEVELOPMENT EXERCISES
The choice is based on all major muscle groups*

CHOICE OF EXERCISES

The general strength training phase is not only responsible for the all-round development of young athletes but must also provide a suitable background for future specific strength training. The choice of exercises can be based on the following:

- Exercises to develop trunk muscles (back and abdominal).
- Exercises to develop arm and shoulder muscles (flexors and extensors).
- Exercises to develop leg and foot muscles (flexors and extensors).

There is a large range of exercises for each of the three groups and the choice should be made according to the developmental stage and performance level of

the young athletes. In general, the basic training phase includes mainly: partner exercises, pulling and pushing games, hopping relays, climbing, games with medicine balls, exercises on gymnastic forms and boxes, and apparatus gymnastics.

All these activities involve the athlete's own body weight or the resistance created by a partner. In the following stages a more formal approach can take place through the introduction of group exercises. These exercises can be performed according to a set number of repetitions, or the number of repetitions that each individual can execute in a time limit (10 to 20 sec.). Typical examples are:

- Individual Exercises: knee bends (leg extensors), push-ups (arm extensors), sit-ups into V-position (abdominal), jump and reach (e.g. extensors), alternate knee bends in front support (arm extensors and abdominal), back arches (back).
- Partner Exercises: sit-ups, feet held by partner (abdominal), trunk lifts in prone position, feet held by partner (back), leg lifts, arms held by partner (abdominal), arm and trunk lifts on a gymnastic bench, legs held by partner (back). Partner exercises include also medicine ball (1 to 2kg) throws, such as double-arm pushing from the chest, double-arm throwing from the chest, right arm pushing, left arm pushing, double-arm throws over the head forward and backward etc.

NOTE: medicine ball exercises can be performed following set repetitions or the number of repetitions executed in a time limit (30 to 60 sec.).

PLANNING

All-round strength development takes place throughout the whole year. According to the competitive needs, the emphasis on strength development shifts, with the main work load performed from November to April. During this phase the beginners should have at least one strength training session a week, the more advanced young athletes at least two. In general, the following recommendations apply:

- The choice of strength development exercises should be limited to 20 or 30 to assure that the exercises are technically well performed for the best training effect.
- Simple tests to evaluate the strength level of each individual should be conducted at the start of a training year to set realistic targets.
- Regular tests should be conducted throughout the year in six to eight week intervals to measure progress and to adjust the training load.

CIRCUIT TRAINING

For many years the most efficient strength development method in the basic training phase has been circuit training. Circuit training has many organizational advantages:

- It allows for a large group to work in a small area and has only limited demand on equipment.
- All athletes work at the same time, making a high training load in a relatively short time possible.
- Training loads and progression is easily determined and adjusted to individual needs.

In designing a circuit it should be kept in mind that:

- The exercises are simple and can be learned in a short time. The exercises should suit the developmental and performance level of the young athletes, be measurable (countable) and have a distinct starting and finishing position.
- The correct choice is made of the muscle groups to be developed, aiming for the desired component of strength (power, muscular endurance etc.).

If the aim is to develop *power*, the following points are essential:

- The circuit should be performed reasonably early in a training session to avoid fatigue.
- Each exercise must be performed fast with sub-maximal and maximal effort. The resistance is restricted to the athlete's own body weight or a light extra load, such as medicine balls. Each exercise is performed in series of no more than 6 to 8 repetitions.
- Recoveries must be sufficiently long to allow the last exercise to be performed explosively.
- Mobility and stretching exercises are recommended between each station to speed up the recovery.

If the aim is to develop *muscular endurance*, the following points are essential:

- Exercises are to be performed with medium to sub-maximal effort. The resistance is restricted to the athletes own body weight. Each exercise is performed in series of 10 to 30 repetitions.

- Recoveries must be kept short to allow for a continually increasing degree of fatigue. * Exercise must be arranged so that stress and fatigue is well distributed without overloading one muscle group.
- Because of the demanding nature to the organism, the circuit should be performed in the second part of a training session.
- It should be noted that circuits aiming to develop muscular endurance have a favorable influence also on the development of general endurance (oxygen transport system).

There is a choice of two main approaches to circuit training for young athletes, based on maximum repetitions or repetitions performed within a time limit. In the maximum repetitions method the athletes are tested for individual training loads within a set time, for example 30 seconds. For the circuit performance the maximums are halved. For example:

- Station 1: Push-ups. Test: 32 reps. Circuit: 16 reps.
- Station 2: Jump and reach. Test: 130 reps. Circuit: 15 reps.
- Station 3: Knee-lifts in hang. Test: 17 reps. Circuit: 9 reps.

The shortcoming of this method is that young athletes have large differences in the number of repetitions to be performed and consequently the time spent at each station varies considerably. This makes organization of large groups difficult. Further, set repetitions based on maximums limits training to one or two variations of circuits, making the workouts monotonous.

In the method based on performing within a set time unit, each athlete performs many repetitions, say in 15 to 20 sec., as possible. The training load is automatically adjusted according to the performance level of each individual. However, the organization is simpler, as all athletes spend the same time on each exercise with the change from one station to another following the coaches signal. In addition, set time circuits do not depend on maximum tests and allow for unlimited variations to be introduced.

SAMPLE CIRCUITS

Suitable in basic training to develop trunk, arm, back, abdominal and leg muscle strength:

Circuit 1: (Emphasis on trunk, arm and leg muscles)

1. Sit-ups with feet supported (abdominal).
2. Two-legged take off jumps over a rope (legs and feet).

3. Trunk lifts in prone position with feet supported (back).
4. Push-ups (arm extensors).
5. Jump and reach (leg extensors).
6. Pull-ups in half hanging position (arm flexors).

Circuit 2: (Emphasis on back and abdominal muscles)

1. Leg raises lying on the back (abdominal).
2. "Star" jumps (legs and feet).
3. Trunk bends forward and backwards with medicine balls (2-4kg) (back).
4. Push-ups with hands on a gymnastic form (arm extensors).
5. Straddle jumps on and off a bench (40cm) (legs and feet).
6. Pull-ups in half-hanging position (arm flexors).
7. Prone position, trunk off the floor, performing the breast stroke (back).

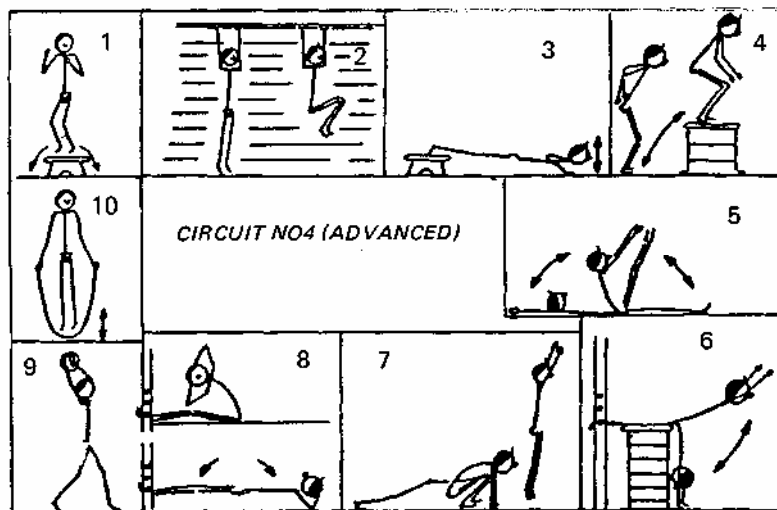
Circuit 3: (Emphasis on arm and leg muscles)

1. Push-ups with feet on a gymnastic form (arm extensors).
2. Squat jumps (leg extensors).
3. Double-arm medicine ball pushes against the wall (arm extensors).
4. Straddle jumps on and off a bench (40cm) (leg extensors).
5. Pull-ups in half-hanging position (arm as flexors).
6. Double arm chest passes with medicine balls against a wall (arm extensors).

Circuit 4: (Advanced) See Fig. 2.

1. Double-leg take off jumps on and off a bench (20 to 40cm) (legs and feet).
2. Knee lifts on a wall ladder (abdominal).
3. Push-ups with feet elevated on a bench (arm extensors).
4. Jumping on and off a gymnastic box (60cm) (leg extensors).

5. Sit-ups into V-position (abdominal).
6. Trunk and arm lifts on a box with feet supported (back).
7. Front support jumps into crouch position and then upwards (complex).
8. Twisting sit-ups with feet supported (abdominal).
9. Double-arm and over head medicine ball throws against the wall from 2.50m distance (shoulders, arms, chest).
10. Double-legged skipping (legs and feet).



Circuit 5: (Advanced, emphasis on trunk and arm muscles).

1. Double-arm and over head medicine ball throws against a wall (2.50m, 2 to 4kg) (shoulders and arms).
2. Knee lifts on a wall ladder (abdominal).
3. Trunk and arm lifts on a box, feet supported (back).
4. "Star" jumps with light weights held in each hand (leg and arm extensors).
5. Twisting sit-ups with feet supported (back).
6. Pull-ups in half-hanging position (arm flexors).
7. Push-ups with feet on a bench (arm extensors).

8. Prone position, lifting of alternate stretched arm over a medicine ball (back).

LOADING

The loading in a training unit depends on the aim of the session to develop a particular aspect of strength, the performance level of the athlete and the stage of his development. Table 1 represents suggestions on the planning of training loads in circuit training, based on the type of exercise, duration of each exercise, recoveries between each exercise and between the series.

TABLE 1

	Power Arms/Legs	Muscular Endurance		Arms/Trunk
		Arms/Legs	Complex	
Duration of exercise (sec.)	up to 10	15-20	15-20	15-30
Recovery between exercises (sec.)	60-120	30-60	20-30	20-30
Recovery between rounds (min.)	2-5	3	3	3
Number of rounds	2-3	2-4	2-4	2-4
Number of exercises	3-6	4-8	6-10	6-10
Total repetitions	60-120	150-400	150-450	120-400

Further help in the planning of circuit training is found in Table 2, representing the duration of circuits according to the number of exercises included, recovery times and the number of rounds to be performed.

TABLE 2

Number of Exercises	Exercise Time (sec)	Recoveries between exercises (sec) rounds (min)		Total time for		
				2	3	4 rounds
3	15	30	3	6.30	11.15	16.00
4	15	30	3	8.00	13.30	19.00
5	15	30	3	9.30	15.45	22.00
6	15	30	3	11.00	18.00	25.00
7	15	30	3	12.30	20.15	28.00
8	15	30	3	14.00	22.30	31.00
9	15	30	3	15.30	24.45	34.00
10	15	30	3	17.00	27.00	37.00