

# Muscle Strength in Adolescents: Postures, Injuries and Therapy

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Short Communication

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## To Muscular Strength in Adolescents

To prepare the force must consider gender, age and strength muscle of the muscle planes, as well as the TECHNIC to the execution of the exercises, because as long as teens grow and develop, increase their strength correspondence to development and maturation of regulatory and musculoskeletal systems. Sex and age on muscle strength has been much studied, agreeing that increases this capacity until the age of 20 or 30, being between 25 and 30 years where the greatest muscular strength is reached and from the age of 30 its growth begins to slow down. With regard to sex, it is known that girls after the age of 16 are two-thirds as strong as boys and that boys are somewhat stronger at puberty.

Strength in adolescent's increases more rapidly from 12 to 19 years, being proportional to body weight, in girls this capacity regularly increases from 9 to 19 years, slowing down until 30 years. Bermudez, et al. consider that between age and muscle strength there is an increment or in a year of muscle strength increases NDO between one 5 -10% average strength of the muscle group, attributing this achievement to the System Central Nervous System (CNS).

Gloper, et al. consider that the force plays an important role in the formation and general development of the child, showing that many do not reach a potential development of performance due to the insufficient stimulation of the motor apparatus. Bigmann, et al. stated that for the development of strength it is important to pay special attention to the potentialities of the organism in the growth stage, since the child's bone system is more elastic, given by its lower calcification, the latter culminating in the body between the ages of 17 and 20 approximately.

For this reason, Jonat, et al. pointed out by Román, et al. [1] argued that despite the organism's predisposition to performance, it is reduced in children and adolescents, mainly in the motor apparatus and in the support apparatus, not preventing muscular effort, but rather stimulate it, but with a level of dosage during training, in addition, despite the fact that the muscles are not very exposed to overtraining due to muscle fatigue, one should not fear injuries due to forced training, since most of the segments that are most injured are the passive parts of

the body.

On the other hand, Karke et al. pointed out by Román, et al. [1] have stated that young school children cannot concentrate more than on a single task at a time and for a short time, for these ages it is more rational and effective to Circuit training, as long as the exercises are dosed according to your level.

Stemler, et al. pointed out by Román, [1] stated that between 7 and 9 years of age, trunk strength achieves greater results. That is why the support on the wall or on a raised support, climbing bars and ropes, oblique suspension tractions and jumps with the feet together, are some natural exercises and with a load that represents the own body weight, they are efficient to develop strength in early school age.

For the second stage, it is convenient to motivate the muscular effort in a general way and in those important muscle groups with exercises with the body's own weight or with small additional loads (medicine ball, sand bags, sand bottles, etc.) [1].

Graus, et al. pointed out by Román, et al. [1] stated that in adolescence the natural desire for movement should be used to obtain a complete and versatile general development of the active and passive motor apparatus, directing them and placing them in learning situations, where stimuli are sufficiently high, in order to promote muscle development and bone growth. This author himself expresses that in the puberty phase the growth spurt translates into an elongation of the size, causing an even disharmony in the body proportions, being unfavorable for the ratio between the length of the levers and the performance potential of muscles.

Under the influence of growth hormones and the sex hormone, the conjugating cartilage undergoes a series of morphological and functional modifications that make it diminish its potential to bear high loads. For this reason, too high training according to the author himself can endanger the integrity of the locomotor system, so at these ages it is necessary to develop a robust musculature, not overloading the spine, since morphological changes begin after 15 years.

Considering these criteria we can propose that strength training for these ages should be aimed at achieving a general harmonic formation of the organism, through its variability, attraction and adaptation to the age in which it is applied.

According to Román, et al. [2] under these circumstances it has been shown that 38 percent of children who practice high-performance sports do not present ailments through the passive locomotor system (bones, tendons, ligaments, cartilage), or muscular imbalances as a result to weaknesses of the muscles of the back, shoulders, abdomen and legs.

All this is also manifested in children 8 years of age and older, but according to their biological and chronological development, such as:

- Muscle growth
- Muscular weakness.
- Production of hormones and enzymes.
- Aerobic and anaerobic energy pathways.
- Bone growth and flexibility (morbidity).

Childhood and adolescence characterized by morphological and functional changes, are stages of transit between childhood and full maturity of the individual, observing changes in the locomotor system, the young person grows constantly between 13 and 15 years, bringing with it this growth weakening In the locomotor system, however, it is the stage in which it is possible to begin to develop maximum strength, being able to work without fear of injury or damage. Given the rapid growth, the cardiovascular system presents a slower development, causing an increase in heart rate and blood pressure, the respiratory system is also insufficiently developed and its vital capacity is low.

The nervous system of the young person is more unstable and processes of excitement are achieved over those of inhibition, appearing, given the aforementioned characteristics of the appearance of fatigue and the rapid recovery of spent elements. All these aspects mean that when planning and dosing activities for adolescents, the coach sometimes feels doubtful about the work of strength with weights, since many are manifested in that they limit growth and affect the cardiovascular system, applying natural exercises or with your own body weight.

These aspects are wrong; the work of the force with weights allows a more exact dose of work considering your main needs.

According to Cuervo, et al. [2] there are several factors that must be taken into consideration for the planning of weights in school age and adolescents, these are:

- **Objectives of weight training:** The exercises can be used to develop the various types of force as part of physical preparation and/or achieve a compensatory development with unilateral or decompensated increase.
- **Age and sex:** To determine the burden that the adolescent must receive, it is necessary to know their age, being able to form age groups, the same happens with sex, which dif-

fers in terms of performance between the two and their development possibilities.

- **Motor experience:** It is important to know if they have been trained or not previously and have not applied force with weights on other occasions.
- **Frequency and duration of weight training within the weekly cycle:** The frequency is usually 1 to 3 times per week. The workouts last between 1 and 2 hours, in order to keep the levels of endogens in the blood high.
- **Motor capacity:** The training must take into account the capacities and work with weights to develop the different types of force, developing the most characteristics.
- **Selection of the appropriate exercises:** The appropriate exercises must be selected, combining these depending on their position (standing, Sitting, Lying down, and Bent over) considering the influence of weight on the spine.
- **Weight of the lever:** The most used way is the planning of the weight collectively, especially for schoolchildren and beginners, being able to subdivide by subgroups, the weight between 30 and 70 % for these ages is not harmful at all.
- **Correct posture during the execution of the exercises:** Special attention must be paid in each execution of the movement, emphasizing the view, the trunk, the legs, the grip and the hold. All these elements help to avoid injuries and bone deformations.

In order to achieve an effective work on the development of strength at school age we recommend:

- Systematically assess the physical and functional state of adolescents.
- Carry out control tests of basic and specific strength
- Exercises, with a view to assessing the progress made.
- Maintain a strict observation of the changes that may occur vary the preparation of schoolchildren and adolescents.

Independently we would like to discuss strength training for women. We must start from the difference between both organisms (woman and man) from the functional point of view, which is of the utmost importance to keep them in mind when conceiving training for this sex. There are anatomical and functional aspects that differentiate both sexes; these have been addressed by Rodríguez, et al. and Cuervo, et al. [2] these are:

- **The size:** The man is taller than the woman between 8 and 10 % that is, between 10 and 13 cm approximately.
- **Body weight:** Women have between 10 and 20 % lower body weight than men that is, between 7 and 8 Kg approximately, less volume and strength in skeletal muscles, making them weaker and more elastic. The ratio of muscle mass to total body weight is between 32 and 35 %, while in men it is between 40 and 50 % approximately.
- **Fat percentage:** Women have a higher percentage of fat, which ranges between 16 and 20 % in the body, while in men it is 12 to 14 %. This aspect constitutes an energy reserve for women that are created from an early age, with a view to facing menstrual processes and pregnancy. Muscle groups: Given the lower levels of plasma testosterone hormone 30 ng/dl per 400 to 1000 ng/dl in men, they make

muscle mass 10 % lower in women, reflected in muscle groups with more complex functional activity as are, the muscles of the back, abdomen and shoulder girdle, which makes them have less strength. Generally, women have a longer and more flexible trunk, with weaker muscles, appearing inappropriate postures such as drooping shoulders and shoulder blades that are separated and directed outwards.

The muscles of the abdomen must be prepared to support a greater load, when considering the period of pregnancy, Yagunov, et al. stated that the muscles of the pelvic region guarantee the normal position of the ovaries and act directly on childbirth. On the other hand, the hips are wider and lower in women, so the center of mass of the body is located lower, there are authors who suggest that the hips constitute a bony ring of defense of the internal organs and the fetus during the pregnancy, observing that the distance between the pelvis and the hip joint is greater than in men. Another aspect to highlight is that the chest in women is smaller, so the diameters and circumferences of the muscles and organs in this area will also be smaller, but with greater amplitude, achieving better complete chest breathing, especially in the second half of pregnancy, when the increased dimensions of the uterus make diaphragmatic respiration limited.

- **The vital capacity:** They are less than in men between 20 and 25 %, that is, it is 1000 cc less, in addition, in one minute 3 to 5 liters of O<sub>2</sub> pass through the lungs of the woman, supplying the whole organism between 150 and 180 cc, while in man in the same unit of time, 5 to 7 liters circulate to the lungs, allowing a supply of up to 200 cc of O<sub>2</sub> to the body.
- **Cardiorespiratory characteristics:** The woman has a higher blood pressure and a higher respiratory and heart rate, presenting less the size of the heart muscle and its weight, oscillating between 10 and 15 % with respect to that of men, making different volumes and capacities cardiac.
- **The red blood cell count:** This blood count for women is 15 % lower (4,800,000/mm<sup>3</sup>) so the concentration of hemoglobin that will transport the blood is lower, maintaining normal values of 12–14 g /% and a hematocrit of 42 + - 5.0 cm<sup>3</sup> /%. This aspect will directly influence the menstrual cycle.
- **Menstrual cycle:** Particularity of the woman that begins approximately between 10 and 14 years and lasts until 45 or 48 years. It lasts between 21 and 42 days, for normal cycles it is 28 days for 60 % of women and to a lesser percent in 42-day cycles, all taken from research in this regard.

This phase also called the ovarian cycle, endometrial period or menstrual period takes into account the follicular phase where the maturation of the ovarian follicle of pituitary hormones occurs, which stimulates the follicles (FSH) that stimulates the ovary to produce estrogens, after ovulation The formation of the yellowish body called the Luteinizing phase occurs, where

the Luteinizing pituitary hormones (LH) and the ovarian hormone progesterone predominate, which, when the ovum is not fertilized, is triggered in menstruation.

It is extremely important to know the phases or stages when changes occur in the endometrial layer due to the influence of hormones, these are: proliferative, ovulatory and degenerative (premenstrual, ovulatory, postovulatory, menstrual and postmenstrual).

For this reason, it is advisable for the coach to know the phases that the body of his athletes goes through, which will allow him to dose external loads, when working with higher loads, since it must be remembered that significant changes are occurring in the female body such as:

- CNS excitability.
- Increase of cardiac frequency.
- Increased blood pressure.
- Changes in the composition of the blood.
- Decreased strength possibilities.
- Decreased resistance and reaction speed.

These changes occur to a greater extent in the ovulatory and premenstrual phases, however young women who exercise face these phases in better conditions, where the cycle tends to last between 3 and 5 days. For these young women it is appropriate to know the control of the loads to be carried out during the phases to better face this moment.

For the work with women, a systematic medical- pedagogical control and the communication of its results is necessary, raising with it the interest and conscious attitude in the training. The lower the physical development of the woman, the more varied the content of the exercises and the progressive (slow) increase in the load. The exercises that form a correct figure must be attended to; the varied exercises exert a wide action on the body, contribute to active rest, reduce exhaustion, motivation and exclude the appearance of postural and functional deviations.

Well-programmed trainings ensure a multilateral preparation, a strengthening of health, an improvement of results. For this reason the exercises with weights are easy to dose, being able to perform in various positions, individually or by grouping the work by muscle planes, the rhythm of movement and the muscular activity regime can be varied. In addition, considering the principle that Sport and Physical Education are means of conservation and improvement of health, the planning of training and its exercises should be directed to strengthening the muscles of:

- **The Back:** The strengthening of the back muscles guarantees the woman the adoption of a correct posture, the most recommended exercises to achieve this are the Reverences, Hyperextensions of the trunk.
- **The Abdomen:** A good strengthening of the abdominal muscles guarantees a slender figure and a correct posture together with the back, influencing the fixation of the in-

ternal organs and preparing them for reproduction. The most commonly used exercises are the push-ups of the trunk and the elevation of the legs on the abdominal table, on the back or on the floor, alone or with the help of a partner.

- **Arms and Shoulder Girdle:** The strengthening of this musculature in addition to contributing to feminine aesthetics has a positive influence on the muscles of the pectorals and those that are inserted into the scapula, helping above all for the daily and voluminous activity that women perform both in the work center and home. Exercises that can be applied are seated, standing, and lying forces, rows, and dumbbell arm raises.
- **Legs:** strengthening this part of the body allows women to activate blood circulation throughout the limb, helping to reduce and in many cases disappear veins (varicose veins), as well as enhancement of feminine beauty. The most used exercises are the scissors, squats, push-ups, extensions and calves; weighted jumping jacks also help strengthen this limb.

For all the aforementioned, we affirm that generally when women are subjected to well-dosed physical activities, the morph functional differences can be infinite, the fact that there are biological and morphological differences, as previously said, cannot deprive the female sex of practicing various sports, luckily forbidden in the past, but with great boom today.

### Postures, Injuries and Therapeutics

One of the essential factors in the achievement of physical activity is the correct execution of the movements, since this allows an equitable distribution of forces, which allows to use the muscles that really intervene in the exercise and I achieve a considerable saving of energy in the correct execution of each movement.

Each exercise has its essential Posture and several start from the same posture, but the three most important parts of the body for any movement are:

- **The Head:** Its position is upright, with the view to the front, at an angle between approximately 35°-45° degrees, commonly this part of the body is called “The rudder of the body”, as it contributes to keeping the back erect and to extensions and flexions. Up the arms For example, if you look down, there is a tendency to lean the trunk and arms forward, causing an imbalance, in the same way it happens behind. In adolescents there is a tendency to look at oneself when they execute the movements of an exercise, this can cause poor execution or the intervention of other planes in the execution of the movement, so the sight is important to always keep it in front and avoid having people in front when the exercises are executed, as this can affect the concentration of the young person.
- **The Trunk:** It is an essential part of the body and its function is to maintain the erect position of the body, in each movement it must remain contracted to maintain a correct position, that is why the muscles that integrate it must be

well strengthened in order to achieve a correct position of the body and at the same time good execution of the movements.

- **The Legs:** Only depending on some exercises it is important that these are kept at the width of the shoulders and sometimes a little wider, all this will allow the center of mass to remain correct, which will cause the movements to be executed correctly.

These three essential elements will allow to adopt a correct position, however when the intensity of the load begins to increase there is a tendency to deform the technique and posture in the execution of the movement, especially in adolescents who are starting in the practice, what which may be a demonstration that there are weaknesses in the muscles involved in the execution of the exercise.

Injuries are more common or have a higher risk in adolescents, since they have muscle groups such as the shoulder girdle (abdomen and back) with great weakness, as well as, for example, growth cartilage injuries, which makes it difficult at these ages important to include exercises to avoid them.

We must clarify that the growth cartilage is located in three main points of the body: In the epiphyseal plate, in the epiphyseal insertion and in the cartilage with the surfaces of the joints. Cervera, et al. state that serious injuries are produced in the epiphyseal plates before ossification, mainly at puberty, causing an arrest in the longitudinal growth of the bone. Injuries to the apophysal insertion of the growth plate which joins the bone with the tendon cause severe pain in the joints and the possibility of separation of the tendon from the bone. The articular cartilage absorbs the impacts between the bones of the joint causing pain when cartilage hardening occurs. These injuries can be caused by sports accidents, microtrauma, among others, which can cause an overuse injury.

### Back and Spine Injuries

Among the bones of the spinal column we find the intervertebral discs, which are made of a gelatinous material highly absorbent to pressures, which can break or deform due to excessive stress and press on the internal nerves or close to the spinal cord, causing a severe and debilitating pain. En positions back is directly or indirectly involved in most movements, since any weight supported with arms or shoulders transmit the force generated at the back.

Cervera, et al. pointed out by Román, et al. [1] refers that the little development in young people of the musculature and the spine carries with it a high risk of injury and back pain, it is common to find lumbar lordosis during puberty and in children, mainly due to the low strength in the hamstring muscles and the growth of the lumbar vertebrae portion more than the posterior portion of these. The main causes of back injuries can be caused by:

- Inadequate lifting technique.
- Incorrect lifting of submaximal weights.

- Excessive arching of the back.

#### We recommend avoiding this type of injury:

- The back should be in a flat or slightly bowed position.
- Use of special belts in exercises that stress the back.
- Achieve a suitable posture in the execution of movements.
- Perform lumbar, abdominal and flexibility exercises in the abdominal and hamstring area with small loads and a minimum of 10 repetitions.

#### Shoulder Injuries

This joint is very prone to injury due to its structure and the pressures it faces. The stability of the shoulder depends on the ligaments, joint capsule and muscles, the shoulder rotators and the pectoral muscles keep the head of the humerus in position. Shoulder movements cause friction between structures, causing discomfort in ligaments, tendons and muscles. It is important to take special care in the technique of exercises where the joint is directly involved.

#### Knee Injuries

The patella and the connective tissue that surround the knee are the most susceptible to receiving the greatest forces that are generated in it. The main function of the patella is to keep the quadriceps tendon away from the knee axis in order to increase the moment of force in the quadriceps and its mechanical advantage. The high forces generated by the patellar tendon can lead to tendonitis. The use of knee braces is not very common, but it can be used to stabilize the knee and avoid fear of injury in the area. In general, we can state that when beginning the practice of exercises with weights, especially in the initial stages, minute muscle discomfort, injuries or inflammation of the muscular structure are caused by reasons such as:

- Myofibrillary lesions in the membrane of band I.
- Lactic acid build-up.
- Developed muscle tension.
- Great metabolic load.

To avoid these injuries it is advisable to carry out moderate activity after training and in the later days.  
Most frequent injuries.

As discussed by Román I, et al. [1] the most frequent injuries are:

- Tendon muscle (insertion tendonitis of the quadriceps and patella).
- Capsule - ligamentous (sprain).
- Bone (spondylolysis and fracture).

#### Lesions of topographic location

- Knees.- 30 %
- Lumbosacral spine. - 18 %
- Shoulders. - 15 %
- Wrist. - 13 %
- Elbows. - 10 %
- Hands. - 6 %
- Others. - 6 %

#### Structural Location Injuries

1. **Knees:** Insertion tendonitis, sprain, osteochondritis, chondromalacia.
2. **Lumbosacral Spine:** Sprain, Spondylolysis (vertebral rotation).
3. **Shoulders:** rotator cuff tendonitis (supraspinatus, infraspinatus and teres minor), capsulitis and tendonitis of the long head of the biceps.
4. **Wrist:** Capsulitis, scaphoid fracture and tendinitis.
5. **Elbow:** Sprain, epicondylitis and epitrochilitis (inside the elbow), ulnar neuritis.
6. **Hands:** Capsulitis of the first finger and hyperkeratosis (Calluses).

These injuries can be caused by a series of factors that greatly influence their appearance, these can be caused by a series of predisposing factors such as:

- Congenital malformations.
- Poor patellar congruence.
- Lower limb discrepancies.
- Lack of joint flexibility, among others.

We also find triggers that influence injuries or traumas such as:

- Microtrauma due to overuse.
- Technical deficiency.
- Heating.
- Dosing of loads.
- Use of prophylaxis.
- No use of means of protection.

It is noteworthy that for its eradication Román I, et al. [1] refers to several elements to treat these lesions, which can be differentiated through their route of application, within them we find:

1. Conservative treatment: Prophylaxis, cryotherapy (ice), contrast baths, flexibility and stretching exercises, general and local massage, hydromassage and paraffin.
2. Drug treatment: Anti-inflammatories, analgesics, muscle relaxants.
3. Rehabilitation treatment: Physical media, currents, ultrasound, magnet, laser, heat (superficial and/or deep).
4. Surgical treatment: Surgical intervention.
5. Corrections and therapy for the prevention of injuries.
6. An essential element in the measures and correction of injuries and trauma that can occur during weight training sessions are the organizational forms that can be applied:
7. Traditional or in waves.
8. Circuits. (By time and by repetitions)
9. Intervals. (By time and by pulsations)

There must be flat security in the means and implements that are used, such as: high and low supports, lying force benches, inclined force and others, as well as crowbars, collars, alterers, dumbbells or other implements.

From the point of view of the young man, he must be concerned with the grip, the hold and the distance of the arms and

hands with respect to the implement, so that a balanced and even grip is achieved.

The young person should train with comfortable clothes and shoes with heels, if they do not have them for squatting, they should fundamentally place small wedges on their feet, with great care, being able to avoid a pull on the ankle joint. When performing exercises with maximum or submaximal loads, two partners must always be present to guide the lever and help the partner, it is also important to place collars in turning exercises specifically for the trunk in order to prevent the discs from coming out of the arm jimmy [3, 4].

In general, there is a range of important hygienic and safety measures to comply with to successfully achieve the preparation of the force (work with weights), below we will present some of them for their application:

1. Advise the young person in the correct execution of the movements and the technical knowledge of the exercises.
2. Apply rehabilitation exercises and preventive recovery of the most common injuries, as well as the strengthening of the muscles that generally suffer the most in their activity.
3. Carry out a deep and adequate general and specific warm-up with a view to raising the temperature and conditioning the muscles involved, including stretching at the beginning and end of each weight training session.
4. Joint pain should not be ignored, as over time they can become chronic injuries, sometimes another segment of the body can be worked, if it does not affect the injured area.
5. It is recommended after each training to massage you with ice, or local or general massage sessions as another way of recovery.
6. It is important to seek ventilation in the area, as well as to stay hydrated during training.
7. It is necessary to place the girdles for the trunk when making great efforts.
8. Special knee pads should be used with care and removed after lifts.

## References

1. Román I (2004). Gigaforce. Editorial Sports. City of Havana: Sports City.
2. Roman I (2010). Multi-force. City of Havana: Editorial Deportes.
3. Cuervo C (2003). Applied weights. Havana. EIEFD Printing.
4. González Duarte LA (2013). Strength Preparation Process in School and Youth Weightlifting Summary Brochure of the Science and Technological Innovation Forum. ESPA Provincial Villa Clara.
5. González Duarte LA, Lanza Bravo, A de la C (2015). Organization; Planning and Control of strength in school weightlifters.

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