

CONSIDERATIONS TO TAKE INTO ACCOUNT WHEN IMPLEMENTING STRENGTH TRAINING PROGRAMS WITH CHILDREN AND ADOLESCENTS

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Abstract: *The purpose of the study was to verify the appropriateness of implementing strength training programs in children and adolescents. A literary review was performed, and it was verified that strength training is beneficial in minors under certain conditions, which includes: a) Undergoing a medical examination. b) Program design and supervision should be made by experts. c) Training workload should be based on years of training, motor skill competence, strength level, biological age and maturity. d) Training principles should be applied in every moment. e) Strength training program objectives should be: Lifelong physical activity promotion, adopting a balanced posture, musculoskeletal development and injury prevention. f) Perform adequate warm-ups before training sessions. g) Weight training techniques should be properly learnt. h) Sports equipment has to be reviewed and adapted to the individuals*

Key words: *Strength training, children, adolescents.*

1. Introduction

One of the most controversial aspects in the field of sports science is strength training with children and adolescents [4]. Historically, strength training has been associated with a set of false myths and beliefs, such as those detailed below [7]:

- Strength training has potential negative growth effects in children.
- Strength training causes injuries when applied to children.
- Strength training is not suitable for children.
- Children under the age of 12 years old should not perform weight training exercises.

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-Strength training deteriorates women's beauty, masculinizing their body.
 -Strength training is suitable only for young sportsmen.

All these fears came out in the 1970s and 1980s because it was proven in some studies that weightlifters had epiphyseal injuries. However, it was possible to verify that those injuries were caused by methodological errors and deficiencies in the in the bodybuilding technique [5]. Besides, many studies have proved that strength training does not produce more injuries than other widely accepted sports [8]. And it was not only demonstrated that it does not impair growth [1]; it has been also verified that generates multiple benefits at all levels, which includes improved health conditions, sport performance, cognitive skills and psychological status[9], [12]. As a result, the benefits derived from strength training outweigh the risks.[13].

Similarly, it has also been proven that strength training is effective for all young people, and not only for those who practice competitive sport. Furthermore, both sexes can benefit from this kind of training [11].

However, it must be taken into account that all these adaptations are attained when strength training meets certain conditions. In this sense, there are sensitive phases wherein certain training stimuli are better assimilated by individuals. Likewise, it is also necessary to know the appropriate training parameters for these ages in terms of volume, density, intensity and recovery time. And finally, there are also methodological aspects related to bodybuilding that must be taken into account.

In this context, the purpose of the present study was to determine under

which conditions strength training should be performed to be effective and safe with people under the age of 18.

2. Methods

A literary review was conducted by using articles published in Scopus, Web of Science and Scholar Google databases. The electable criteria were: a) Articles written in English or in Spanish. b) Articles published in the last six years. c) Studies conducted with subjects under the age of 18, who do not practice competitive sport. As shown in figure 1, the total number of papers found was 3944, and 3934 were excluded on the basis of title, abstract, duplication, or because do not meet these election criteria.

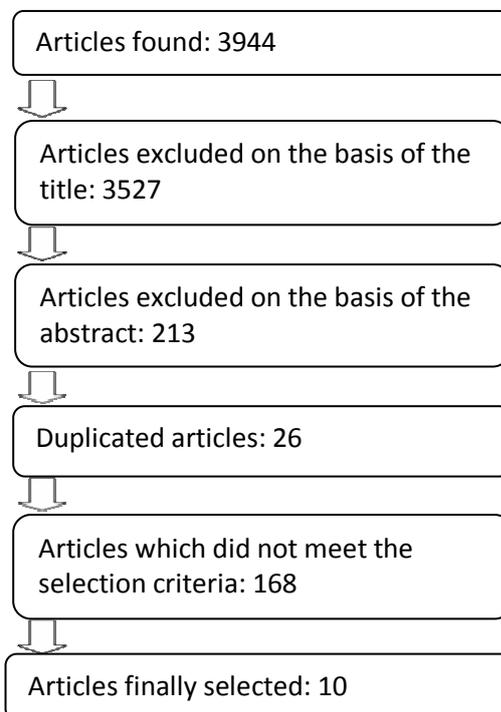


Fig. 1. Flow chart of article inclusion and exclusion

Thus, 10 were finally included. The search terms were: "Resistance training youth", "resistance training children", "resistance training adolescence", "strength training youth", "strength training children", "strength training adolescence".

3. Analysis and Discussion

The possibility of attaining strength improvements depends on factors such as age, sex, or maturity. In 2015, Falk & Tenenbaum state that at present, it has not been possible yet to verify the effect of age on strength. They also indicate that most of studies conducted in the field of youth strength training were with boys or mixed groups of boys and girls. Therefore, the influence of sex on the effectiveness of strength training in prepubertal children still remains unclear. However, studies in which boys and girls were examined separately, no difference was found in the effect of strength training between the two sexes [8].

Meanwhile, Moran et al. (2018) point out that individuals with greater height, weight and age respond better to strength training programs [11]. Thus, maturation could be a moderating factor of the adaptations that can be attained. Besides, since maturation in women occurs faster than in men, physical and coordinative workload requirements should be adapted to this circumstance.

But regardless of the factors which may influence strength adaptations in youth, Faigenbaum (2018) stresses the importance of initiating strength training at an early age. He considers that it is essential for the long-term physical development of individuals, and plays a key role in improving muscle functions, health conditions, physical literacy and

preventing the risk of injury [6]. Similarly, some studies highlight the effectiveness of strength training in youth. Falk&Tenenbaum (2015) conducted a meta-analysis wherein nine studies of strength training with youth were examined, and they verified that most of the studies showed an improvement in strength between 13 and 30% [8]. Moreover, Faigenbaum (2018) indicates that power training is more effective to improve power parameters, and strength training is more effective to improve the sprint ability [6]. In this sense, several studies have analyzed the adaptations produced by strength training [2], [3], [5], [6], [14]. These adaptations are shown in table 1.

Table 1
Strength training adaptations in youth

Sport performance improvement	Increased motor skill performance, acceleration, and sprint, jump and throw ability
Muscular improvements	Increased muscle strength and power
Bone improvements	Increased bone mass and skeletal health. Reduced risk of fractures
Basal metabolism improvement	Reduced central adiposity and unhealthy weight gain
Improved insulin sensitivity	
Improved cardiac function	
Psychosocial benefits	Improved self-esteem and physical literacy
Injury prevention	Reduced sports-related injuries

All these adaptations in young people are attained by training under specific

conditions [6],[11], [12], [15]. Training parameters are shown in table 2:

Table 2
Youth strength training parameters

Intensity	60-80%
Sets	2-3
Repetitions	8-15
Number of exercises	6-8
Weekly training frequency	2-3 days per week
Training methods	Conventional strength training methods, plyometric training (low intensity), and combined training methods
Type of strength	Body weight and external loads

Besides, the implementation of strength training programs in youth must be done taking into account the following conditions [10-12]:

- a) Medical examination: Before starting the program, both children and adolescents must undergo a comprehensive medical check-up to rule out they have injuries or illnesses that may limit the practice of physical exercise.
- b) Training programs should be designed and supervised by qualified professionals with deep knowledge in sports science. Similarly, parents, physical education teachers, coaches and health professionals should recognize the benefits of strength training for children and adolescents in terms of health and physical fitness. They should also be aware that not performing strength training may be a health hazard for youth.
- c) The physical exercise prescribed should be based on personal goals, time availability, medical and sport background, years of training, motor skill competence, technical capacity and existing strength levels. The biological age and psychosocial maturity should be also considered.
- d) Training principles must be applied in every moment. This ensures that the training program will be effective and safe, and the planned objectives will be achieved.
- e) The objectives of the strength training program will be: Lifelong physical activity promotion, adopting a balanced posture, musculoskeletal development and injury prevention. A wide variety of weight training stimuli and exercises integrated in a well-rounded training program should be used to prevent stagnation. Similarly, regular participation in a variety of physical activities that facilitate adherence to healthy physical activity must be encouraged.
- f) Adequate warm-ups should be performed before the training sessions. The warm-up will be designed in accordance with the nature, duration and intensity of the strength training session. Characteristics of youths must also be taken into account. After finishing the training session, an adequate cool down should be made.
- g) Weight training technique should be properly learnt, and exercises must be performed with the proper form. This will allow children and adolescents to stimulate the muscles they are trying to strengthen, whilst reducing the risk of injury and avoiding that weight training machines and sports equipment can be damaged.

h) Weight training machines and sports equipment must be adapted to the characteristics and anthropometric dimensions of young people, and must be regularly reviewed.

4. Conclusion

Strength training does not impair growth, and there is solid scientific evidence in favor of using this type of workouts since it has a positive impact on sport performance, musculoskeletal system, basal metabolism, cardiac function and psychosocial condition. However, strength training in youth is effective and safe only under certain conditions. First of all, children and adolescent should undergo a medical examination. The strength training program should be designed by experts. Training workload should be based on individual characteristics of the youth. Training principles should be applied throughout the implementation of the training program. The strength training program objectives will be: Lifelong physical activity promotion, adopting a balanced posture, musculoskeletal development and injury prevention. An adequate warm-up should be performed before training sessions. Weight training techniques should be properly learnt and exercises must be performed with the correct form. Sports equipment have to be reviewed and adapted to children and adolescents.

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