The Effectiveness of Resistance Training in Children
A Meta-Analysis

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Summary

Many recent studies have reported that resistance training can be effective in producing strength gains among prepubescents. These studies appear to refute the early claims of ineffectiveness of resistance training in children.

A meta-analysis procedure combines the results of individual empirical studies and estimates a standardised effect, termed effect size. This effect size is based on the scores of the control and experimental groups before and after training. It defines the difference between the gain of the experimental and control groups, divided by the standard deviation of the pooled variances of both groups.

A literature search revealed 28 studies which described a resistance training programme for girls and boys under the age of 12 and 13 years, respectively. Presumably, these children were pre- or early-pubescent. However, only 9 of these studies provided the necessary data to calculate the effect size and could be included in the analysis. The majority of the studies showed a gain in strength between 13 and 30\%. The overall mean effect size was found to be 0.57. This signifies that following training, the average child in the resistance training group was above 71.6\% of the children in the control group.

The effectiveness of resistance training can be influenced by factors such as age and maturation, gender, as well as the frequency, duration and intensity of the training programme. The studies included in the analysis examined participants of varying ages and did not demonstrate a clear influence of age. Most studies examined only boys or a mixed group of boys and girls. Therefore, the
Influence of gender on the effectiveness of resistance training in prepubescents cannot yet be determined. Nevertheless, in the few studies where boys and girls were examined separately, no difference was found in the effect of resistance training between genders. It appears that a training frequency of twice per week is sufficient to induce strength gains in children. However, the minimal, or for that matter optimal, duration and intensity are not clear.

Some of the weaknesses observed in the reviewed studies include: (i) the lack of control for a possible learning effect; (ii) non-randomisation into the training and control groups; (iii) no report of adherence rate; (iv) a reliance on boys as study participants; and (v) too little information on the type, volume and intensity of training. Future studies should take these weaknesses into consideration.

1. The Effectiveness of Resistance Training

Resistance training for children and adolescents has been a topic of great interest for the past several years among scientists and physicians, coaches, young athletes and their parents. The extent of youth participation in such training is not well documented. However, a recent national survey reported that in 25% of the health clubs employing certified graduates of Israel’s national school for coaches, most of the trainees (60%) were under the age of 18 years. Half of those adolescents (48.9%) were below the age of 16 (unpublished data). In Israel, the law does not permit children under the age of 14 years to exercise in public weight rooms. Thus, although not well documented, it is apparent that resistance training is commonly practised by adolescents. The extent of resistance training by children is unknown.

The efficacy, benefits and possible risks of resistance training have been extensively studied in adults. In children and adolescents, on the other hand, there is much less information and much more uncertainty.[1-3] The studies which have investigated the effect of resistance training in children and adolescents often suffer from methodological shortcomings, such as the absence of a control group or an inappropriate training programme.

For many years, resistance training was not recommended for children and adolescents for two reasons. First, the immature skeleton of children, and especially of adolescents, was believed to be more prone to injury and to possible interference with growth. Secondly, it was claimed that resistance training of children, especially prepubescents, was not effective.

The issue of injuries associated with resistance training was recently discussed by Macera and Wooten.[4] They concluded that, among children and adolescents, the potential severity of injuries resulting from resistance training is similar to that caused by American football. Hamill[5] on the other hand, reported the results of a British survey in which the rate of injury among adolescents engaged in resistance training and weight lifting was much lower compared with other sports (e.g. rugby, football, tennis). Some retrospective reports of injury in relation to resistance training exist, but are few in number.

None of the prospective resistance training programmes (in which training was well supervised) reported any skeletal fractures. Sale[3] and Michelis[6] claim that skeletal injuries can be prevented with proper technique and supervision, a progressive training programme and avoidance of ballistic movements. Furthermore, Blimkie,[2] in his extensive review of the literature, contends that there is no indication that resistance training is riskier than other youth sports or recreational activities in terms of the incidence or severity of musculoskeletal injury.

Based on a few early studies, it was claimed that resistance training does not result in improved strength or power of children, especially prepubescents. In fact, in 1983, the American Academy of Pediatrics[7] suggested that ‘maximal benefits are obtained from appropriate weight training.