

Resistance Training and Sports Performance in Children: A Brief Review

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Introduction

With the success of the London's bid for the UK Olympics in 2012, coupled with the recently announced major government investment in performance sport, the question of enhancing sports performance in today's young athletes through resistance training is a salient issue for Strength & Conditioning coaches working in the UK. Although resistance training for children was previously thought to be both ineffective and dangerous^{1,7} several prominent organisations such as BASES⁴ and the N.S.C.A.¹³ have produced position statements and literature reviews promoting resistance training as being both safe and effective for youth populations. However, the relationship between resistance training and sports performance in children is still unclear. The purpose of this paper therefore, is to examine the existing evidence relating to this important issue.

Resistance Training & Sports Performance in Children

The first question to address is whether or not resistance training can actually enhance strength and power in children. The early research of Docherty *et al.*¹¹ and other researchers^{20,28} found that resistance training had no effect on strength in prepubescents and attributed this lack of improvement to low levels of circulating androgens. However, there were a number of methodological flaws in these studies. For example, Heatherington's²⁰ subjects trained isometrically but were tested dynamically. Moreover, the intensity of the training interventions employed was low and the duration short which is likely to have minimised any strength gains.¹³

In contrast, more recent research has consistently demonstrated that a variety of resistance training protocols have the potential to significantly increase muscle strength in children.^{5,9,10,14,15,26} Meta analyses by DeOliveria and Gallacher⁸ and Falk and Tennenbaum¹⁶ state that the weight of evidence indicates that resistance training programmes of sufficient duration and intensity are effective in promoting strength gains in children. This enhanced neuromuscular function appears to be largely mediated by neural adaptations such as increased motor-unit recruitment and synchronisation, decreased autogenic inhibition, increased rate coding and enhanced motor coordination.^{12, 23}

Based on the above, it is tempting to speculate that these adaptations have the potential to improve performance in a variety of sports. Several studies investigating this hypothesis have been carried out, although some have found no effect on performance. For example, Ainsworth² found that swimming performance was not improved as a result of a programme of isometric strength training. However, the fact that the training intervention consisted of static training for what is a dynamic sporting movement means that little weight can be given to the findings of this study. Ford and Pucket⁷ found that resistance training had no effect on a variety of specific basketball skills. However, this study was also conceptually flawed in that resistance training may not improve performance in ball games such as basketball by improving specific skills *per se*, but rather by enhancing important aspects of motor fitness which relate to the player being able sprint, jump and change direction more effectively.²⁷

Some evidence does exist however, that appropriately designed resistance training protocols have the potential to improve sports performance in children. Blanksby and Gregor³ found that a programme of resistance training improved performance in a 100 yard swim test in youth swimmers, and Bulgakava *et al.*⁶ also noted favourable improvements in swimming performance as a result of resistance training. Moreover, Queary and Laubach²⁴ noted improved performance in selected gymnastic events. However, although these studies suggest that resistance training can improve sports performance in children, a lack of detail relating to training methodologies and control measures limit the conclusions which can be drawn.

Improvements in motor fitness as a result of resistance training may be important to performance in sports such as ball games and racquet sports, which require repeated power based activities such as sprinting, jumping, and rapid changes of direction.²⁷ Several longitudinal studies support the concept that resistance training can have a beneficial effect on different aspects of motor fitness. Williams²⁹ noted improvements in 30m sprint time and agility run performance in prepubescents after a programme of resistance training. Falk and Mor¹⁵ found that resistance training increased jumping ability in 6 to 8 year old boys, and Hetzler *et al.*²¹ found that a 12-week resistance training programme resulted in an 8.7% improvement in the vertical jump performance in pre-pubescent males, although no improvement was noted in peak power on the Wingate test. The modest improvement in vertical jump and lack of improvement in the Wingate test may be explained by poor exercise selection, in that the exercises chosen bore little resemblance to the motor fitness tests both in terms of movement pattern specificity and velocity. An important study in this regard was that of Diallo *et al.*¹⁰ who investigated the effects of a 10-week plyometric training programme on motor fitness in prepubescent boys. Significant improvements compared to controls were noted in peak power; counter-movement jump; and sprint velocity. On the basis of this study, and also that of Neilson *et al.*²² it appears that the specificity of the resistance training protocol is critical in the transfer

of increased strength and power to improvements in tests of motor fitness.

It can therefore be speculated that, when programmes are of sufficient intensity and duration, resistance training has the potential to improve sports performance in children.^{13,18} However, it



Favourable improvements in swimming performance as a result of resistance training have been noted.

appears that adaptations in children are specific to the velocity of movement, contraction type, and the movement pattern of the exercises employed.^{22,19} The lack of consistent evidence for resistance training to improve sports performance can largely be attributed to the fact that many of the resistance

training protocols utilised in research to date, have used exercises which bear little biomechanical resemblance to the tests of motor fitness employed as outcome measures. However, the limited evidence which is available suggests that a sport specific resistance training programme can result in improved performance in young athletes.^{13,18}

Practical Applications

It is important to bear in mind that much research remains to be done in order to fully evaluate the link between resistance training and sports performance in both pre-pubertal children and adolescents. Although the existing evidence does tend to support using resistance training to enhance performance in young athletes, it may be that the most important role of youth resistance training relates to its role in long term athlete development. In this regard, resistance training programmes for young athletes may serve as an extended preparatory period in which the young athlete lays the foundations of training habits, exercise technique and anatomical adaptations which can be exploited fully to enhance sports performance during later stages of their development.

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