



# Resistance Training for Children and Adolescents

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# Introduction

Resistance training for children and adolescents has for a long time been frowned upon. However, research is showing that it can play a hugely important role in both the health and sporting potential of our young people.

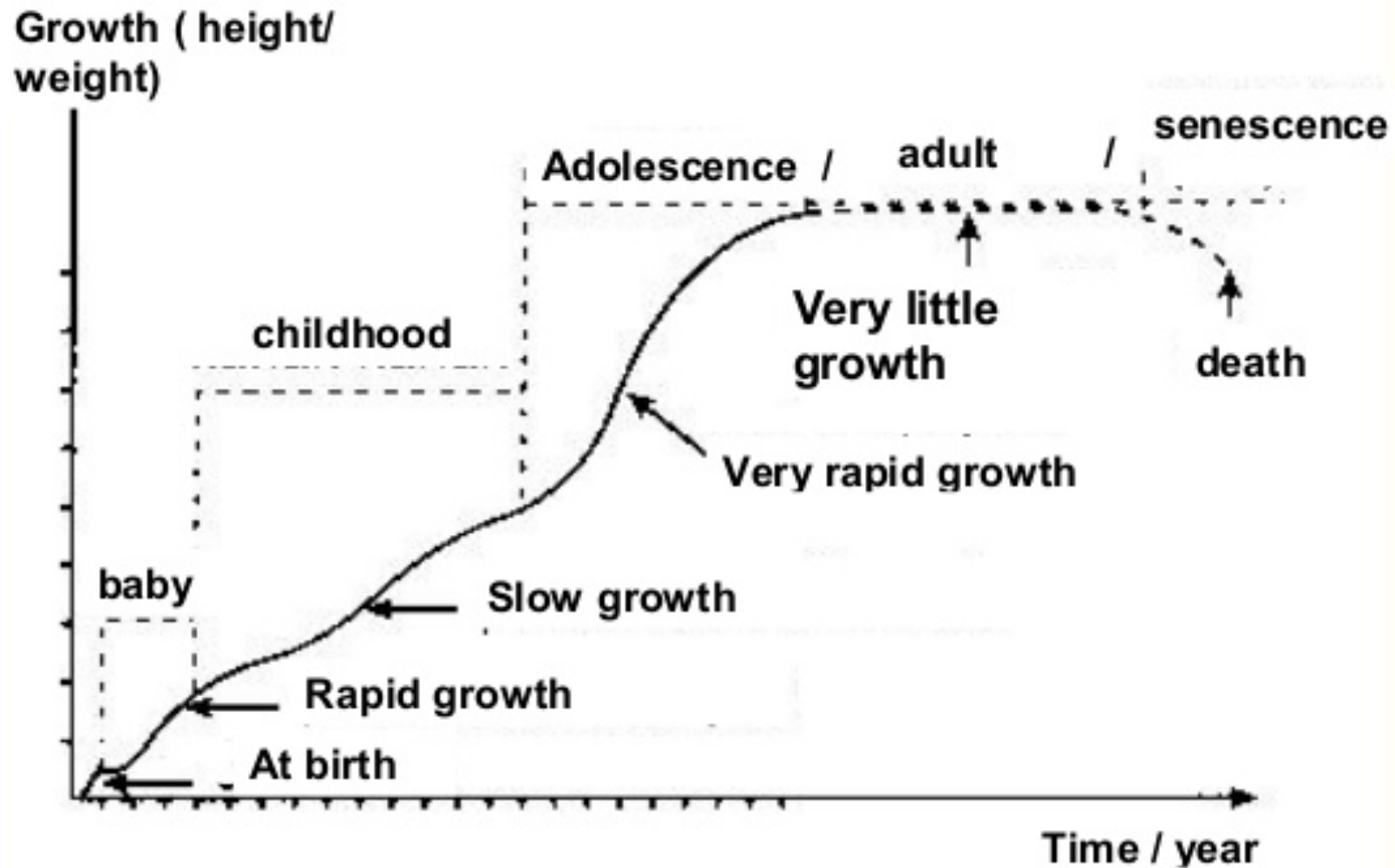
Terms and their definitions used in this presentation are:

- Childhood
  - Period of life from birth until puberty (usually 11yrs girls and 13yrs boys)
- Adolescence
  - Period of life from onset of secondary sexual characteristics (puberty), until adulthood (usually 18-21yrs)
- Growth
  - Change in body size, shape or body composition
- Maturation
  - Timing and tempo of physical growth from childhood to adolescence and beyond
- Training age
  - Number of years an athlete has been involved in a formalised training programme

# Child/adolescent resistance training effectiveness

Research indicates that appropriately designed, and well supervised resistance training programmes can benefit youth of all ages, with children as young as 5 years of age making noticeable improvements in muscular fitness

# Human growth



# Childhood strength

- Throughout childhood strength increases in a linear fashion
- Strength increases in childhood appear to be related to development of the central nervous system:
  - Motor unit recruitment
  - Firing frequency
  - Synchronisation
  - Neuro myelination (myelin sheath increasing conductivity of nerves)

# Adolescent strength

Strength increases at onset of puberty

- Boys strength increases are significantly greater from this point
- Girls strength increases are still relatively linear from this point
- Strength increases result due to presence of androgens including:
  - Testosterone
  - Human Growth Hormone
  - Insulin-like growth factor
- Increases in strength are the result of:
  - Increase in cross-sectional area
  - Muscle pennation angle (direction of muscle fibre within the muscle)
  - Muscle fibre differentiation (fast/slow)

# Biological v chronological age

Growth due to the onset of puberty occurs at different times and at different rates for children. Therefore children of the same chronological age may be disadvantaged against children of a higher biological age. Differentiation must occur in order to provide child-specific programmes from a safety and a developmental point of view

Additionally, training age must be taken into account. A child with a higher training age, but lower biological or chronological age of a peer may be capable of more from a strength or motor skill perspective

# Health benefits

The health benefits of resistance training for children and adolescents include:

- Musculoskeletal health
- Body composition
- Cardiovascular health
- Injury prevention

Additionally, due to its nature, resistance training holds less impact and motor control related issues for sedentary children who may be overweight or obese, than more traditional sports or activities. In fact, resistance training could play an important role in preparing these young sedentary people for further activity or sport



# Health risks

There has been a widely held belief that resistance training from a young age can adversely affect a child's growth and also be a potential injury risk. Growth plate fractures have often been cited as being of particular risk. In fact, there is no scientific evidence to suggest that this is true. Conversely, resistance training and other high stress inducing sports have been shown to be beneficial for bone formation and growth

# Injury prevention

- Resistance training that is focused on reducing the risk factors can reduce the risk of injury by up to 50% (Chan, Micheli et al, 2006 / Valovich-McLeod, 2011), due to:
  - Increased muscle strength
  - Enhanced movement mechanics
  - Improved functional ability(assuming correct programming that highlights appropriate areas to work on)
- Pre-season training is highly recommended to reduce injury risk, along with in-season training to maintain benefits

# Considerations for girls

- Musculoskeletal growth for girls during puberty, without the corresponding neuromuscular adaptation may facilitate the development of abnormal joint mechanics and injury risk factors in young girls
- Attention should be paid to functional movements that increase neuromuscular adaptations
- Training should be year-round in order to maximise benefits and minimise regressions – especially during puberty

# Expectations

- Strength gains of 30-40% for untrained children
- With 4-5 years of training, relative strength levels (1RM kg/kg body mass) in the back squat should be a minimum of 2.0 for late adolescents (16-19 yrs); 1.5 for adolescents (13-15 yrs); and 0.7 for children (11-12 yrs). (Keiner et al, 2012)

# Olympic weightlifting for children

If progressed in a suitable fashion and coached effectively, Olympic Weightlifting has been shown to carry a lower injury risk than other forms of weight training and other sports

Olympic lifts are highly skill-based and therefore time should be taken to learn the movement patterns associated with them before any increase in resistance

The use of weightlifting as part of a multifaceted youth-based resistance training programme is supported, on the proviso that training prescription is designed in line with the maturational status, training age, and level of motor competency of the young athlete

# Resistance training recommendations for children

Programmes should be:

- Aimed at developing movement pattern
- Aimed at developing strength
- Aimed at instilling confidence

Programmes should not be:

- Aimed at increasing muscle mass

A Long term approach to athlete development should be implemented:

- Programmes should last longer than 8 weeks
- Programmes should be appropriately periodised
- Reducing training frequency with increased training intensity best

# Training variable – exercise selection

- Technical competency prioritised
  - Consideration made to biological and training age
- Equipment should be suitable
  - Machine weights preferred for sedentary
  - Freeweights preferred for technically competent children
- Choices based on ability and fitness level
- Progression to higher motor control and force producing exercises

# Training variable – Volume and intensity

- The number of sets and reps of an exercise and the intensity with which the exercise is undertaken are inversely proportional
- Intensity and quality are recommended above volume in order to decrease injury risk (injuries tend to occur towards the end of sets when athlete is fatigued)
- 1RM or predictive 1RM tests should be used to programme exercises for individuals (not one-size-fits-all approach)



# Training variable – Frequency and type

- 2-3 times per week on non-consecutive days recommended
- Consideration given to other activities and total exercise volume
- Care taken to not over-expose a child to similar routines that increase overuse injury risk and do not promote good motor development opportunities
- Maintenance of training in-season important to reduce injury risk

# Training variable – Repetition velocity

The velocity of each repetition of an exercise should be carefully controlled according to training age and competence

- Slow to moderate speed recommended for low training age / competence (control highlighted)
- Moderate to fast speed for medium to high training age
- Ultimately, the full intent to move quickly will benefit sporting performance the most as it has the biggest effect on neurological adaptation

Repetition velocity may change through a session – generally, more explosive exercises are completed at the start of a session with slower movements coming afterwards

# Training guidelines

Training experience	Beginner	Intermediate	Experienced	Advanced
Volume (sets x reps)	1-2 x 8-12	2-4 x 6-10	2-4 x 5-8	2-5 x 2-5
Total number of exercises per session	6-10	3-6	3-6	2-5
Intensity (% 1RM)	BW or up to 50-70%	60-80%	70-85%	85-100%
Repetition velocity	Moderate-fast	Moderate-fast	Fast-maximal	Maximal
Rest intervals	1	1-2	2-3	2-5
Frequency (sessions per week)	2-3	2-3	2-4	2-5
Recovery (hours between sessions)	72-48	72-48	48	48-24

# Coaching of children and adolescents

Feedback is an integral part of a coach's role. A coach should provide regular feedback based on their situational ability. Feedback may be rep by rep, or may be set by set according to the child's ability and awareness.

When coaching larger groups, less frequent feedback is accepted, though efforts should be made to limit the number of participants a coach is dealing with – especially when the group has members of a low training age or ability