Training Considerations - Children Are Not Small Adults

http://concept2.co.uk/training/guide/not_small_adults

Craig Sharp, Professor of Sports Medicine at Brunel University states that: "children are not small adults in terms of their exercise physiology; their responses to exercise may be quite different."

Whilst this is undoubtedly true there are many cases of young children performing to the highest level in sports like gymnastics and swimming, and there is record of children as young as 7 completing a marathon in under 3hrs 30 mins. So it is clear that children are capable of outstanding performances, the side effects of these performances may, however, be drastic in later life. It is important then for coaches to understand that their role is not only to get the most out of their charges but also to protect them from themselves and in many cases over-ambitious parents. For more information about the physiological changes that take place during puberty see Changes at Puberty later on in this Section.

Children of different ages vary greatly in their development and for this reason training can be separated into different Key Stages. These are the same five key stages identified by chronological age in British schools, however biological and chronological ages are not always the same, for this reason a section called Biological Age has been added after the information about the different Key Stages.

Key Stage 1 (FUNdamental), is for children of 4 to 7 years and should be devoted to developing the child's fundamental movement skills. Key Stage 2 (Learning to Train) is for children of 8 to 11 years and should be devoted to overall sports skills development and the development of global co-ordination. Key Stage 3 (Training to train) is for children of 11 to 14 years and should be devoted to developing the young person's physiology and further developing sports specific skills. Key Stage 4 (Training to compete) is for young people of 15 to 18 years and should be devoted to fine tuning, not only the sports specific skills but also the physiology. Key Stage 5 (Training to win) is for young adults 18 to 22+ years and should be devoted to maximising potential. It is important to understand that the rate of maturation of children varies according to the sex of the child, and also from child to child. For this reason it is sometimes possible to progress children more rapidly through the Key Stages if they are early developers, and spend more time in the lower key stages if they are late developers. A fuller explanation of the physiological differences between children and adults can be found at the end of this section for those who are interested.

Table 10.1

The Five Key Stages															
Age															
4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	------>
KS1				KS2				KS3			KS4				KS5
Fundamental movement skills				Overall sports skills development				Building the engine and sports specific skills			Fine tuning the engine and sports specific skills				Maximise potential

Key Stage 1: FUNdamental (4 to 7 Years)

Emphasis of this stage of learning is developing fundamental movement skills. From the name given to this stage it can be seen that the overriding criteria is for the participants to enjoy themselves as these are the building blocks for an active lifestyle as an adult. This requires a well structured programme to develop physical capacity using a wide range of sports and activities where fundamental movement skills are mastered. Before puberty stamina (endurance) improvements are mainly due to an improved economy of movement where oxygen consumption for any given activity goes down without increase in VO2max. Therefore the emphasis should be on teaching technique during all activities, and improving strength through bodyweight exercises and the use of

medicine balls and Swiss balls. The activities should revolve around the school year, and where ever possible activity camps should be attended in the summer and winter holidays.

A five year old learning movement skills

It is recommended that one sport is not practiced more than twice per week, and participation in other sports should take place three to four times per week. If at the end of the FUNdamental stage the child does not wish to continue in competition then the skills learned in this stage will not be wasted but will be beneficial in terms of their interaction with others and general health and well being.

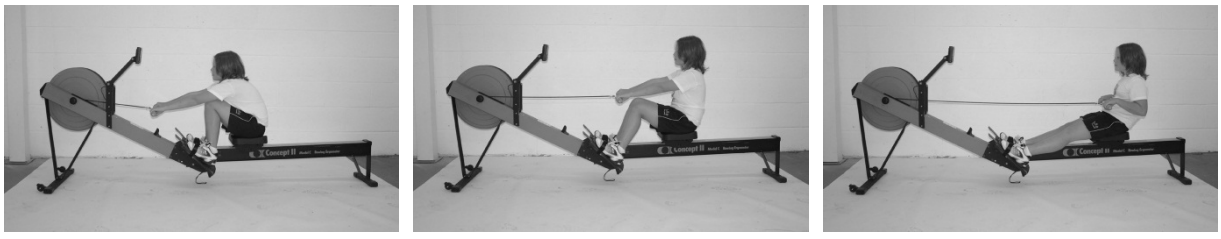
Key Stage 2: Learning to Train (7 to 11 years)

This stage emphasises the learning of overall sports skills. During this phase the athlete learns how to train and become aware of the different forms of training and their effect. Where the long-term aim is towards a specific sport then specific skills are developed. They are introduced to the basic technical and tactical characteristics of the sport as well as the pertinent warm-up, cool down and stretching exercises.

At this stage they are introduced to the relevance of hydration, nutrition and the relationship between training, recovery and regeneration. Mental preparation is developed and programmes will include tapers and recovery.

Indoor rowing categories start at J11 and so it is during this stage that the machine is introduced. It is quite normal for the legs to be stronger than the upper body and arms and this may manifest itself in the athlete not swinging the body and or not being able to draw the handle into the body at the finish. The reduced body swing should be tolerated until the upper body strength is developed. This can be helped by gymnastic activities which include hand balancing, cartwheels and walking on the hands.

Whilst training remains focussed on learning the basics, during competition the athletes are encouraged to do their best and strive to win.



A nine year old exercising on the rower

Key Stage 3: Training to Train (11 to 15 years)

The training to train stage is characterised as building the engine and sports specific skills during this the critical and sensitive period of physical and skill development. During this period it is important not to over compete as this will take up valuable training time. Competition is still important to enable the athlete to meet the physical and mental challenges presented. It is also important to develop technical skills in a competitive environment. The ratio between competition and competition/training is nominally 25%-75%. This may vary depending on the

nature of the sport and the competition component may be higher in sports that are predominantly physical such as indoor rowing and less in sports that require a high level of skill. The most important aspect of this period is to match the volume, frequency and intensity of the training programme to the individual to take advantage of accelerated adaptation, (described in more detail later).

A 12 year old exercising on the rower

Key Stage 4: Training to Compete (15 to 18 years)

Characterised by the fine-tuning of the engine and sport specific skills. We move onto this stage once the Training to Train stage objectives have been reached. Competition to training ratio changes to 50/50 so that half the training is devoted to technical, tactical skills and increased fitness level while the other half is devote solely to competition training and to competitions. Training intensity increases and becomes more sport-specific as an all year round programme is developed to meet the individual needs of the athlete, aimed at resolving individual weakness. This will involve technical, physical and psychological development programmes designed to raise the athlete's performance for competition. The leg/upper body strength imbalance should have been corrected by now and a normal body swing, which represents 20% of the overall stroke length, should be evident.

A 15 year old exercising on the rower

Key Stage 5. Training to Win (18 to 22 years)

The aim is to maximise sports specific skills. This is the final stage, which starts with males at age 18 and females at age 17. All of the athlete's physical, mental and technical capacities are fully established and so the focus of training is devoted to optimising performance. Training volume and intensity are increased and developed to bring the athlete to a peak for major competitions. Recovery and regeneration elements of the programme are essential to prevent physical and mental burn out.

Training Considerations - Biological Age

http://concept2.co.uk/training/guide/biological_age

Although putting children into chronological age groups fits neatly into the academic system, for physiological purposes it is the biological age that is important. Tables 10.2 and 10.3 are schematic presentations of adaptation to training and optimal trainability for girls and boys. Age grouping is simple and a system that everyone understands and so is a good place to start. But because the biological differences can be so great, especially between the ages of 10-16, there are other indicators we can use to determine critical periods. Having identified these critical periods then if the correct volume, intensity and frequency of exercise are applied then accelerated adaptation will take place.

Table 10.2

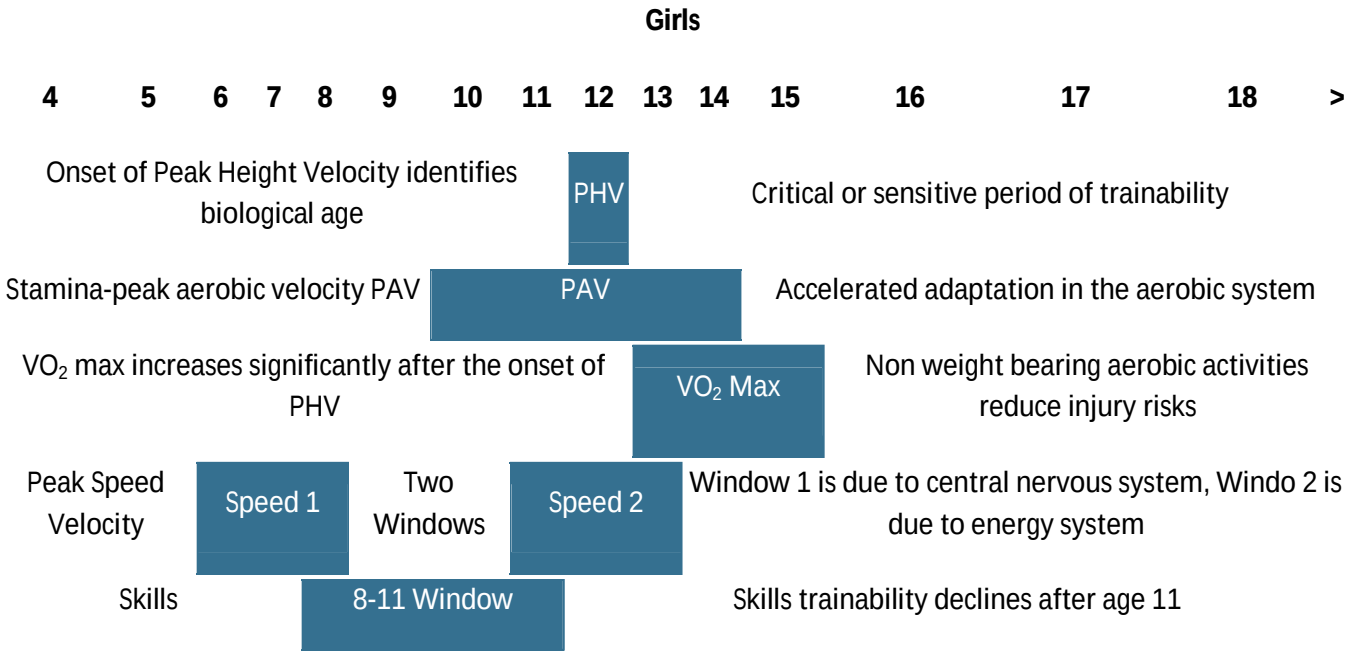
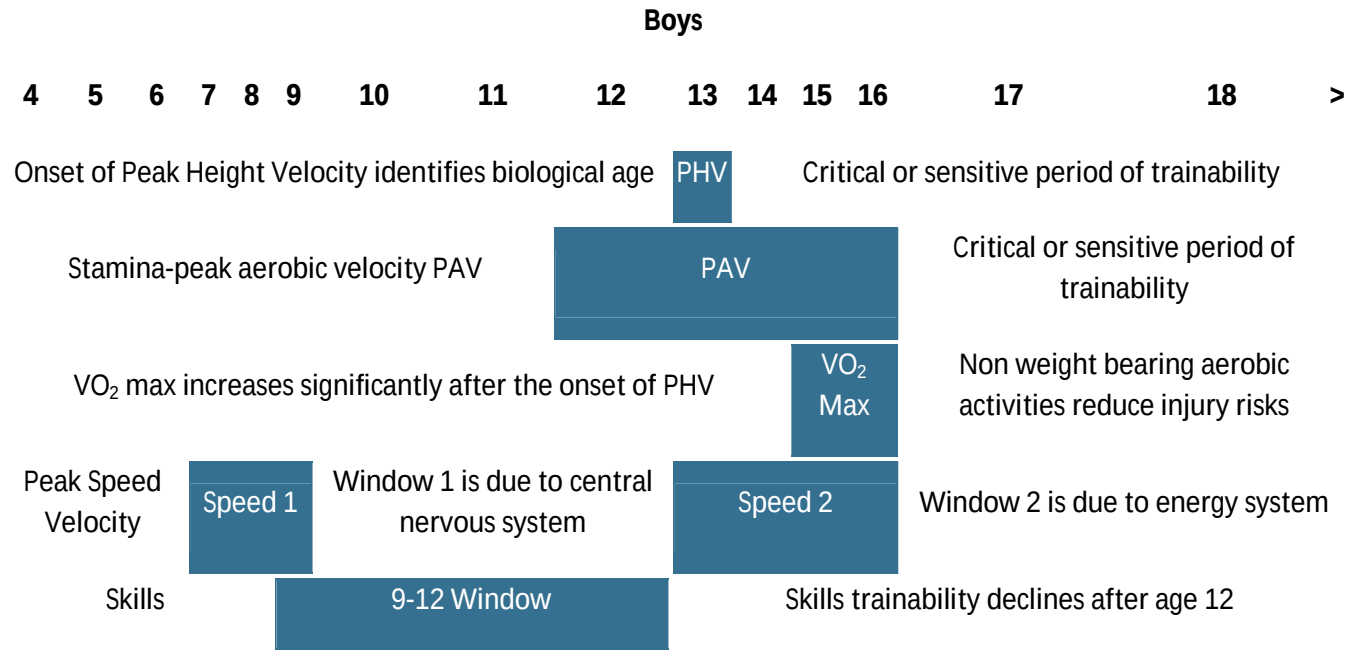


Table 10.3



NOTES: *See text below for a full explanation of terms used*

PHV

Peak Height Velocity. By regularly measuring the height of children you can determine the average annual growth rate or height velocity. Pre-pubertal height velocity is around 5-6cm/year. During peak height velocity (PHV), this can increase to 9-10cm/year. PHV is a reference point for the design of optimal individual programmes with relation to critical or sensitive periods of trainability during the maturation process.

Prior to the onset of PHV boys and girls can train together and chronological age can be used to determine training, competition and recovery programmes. The average age for the onset of PHV is 12 in girls and 14 in boys however this is influenced by both genetic and environmental factors, including climate, cultural and social influences.

The onset of PHV is not age dependent but is a valuable reference point not only for the development of the athletes energy systems but also the central nervous system for skills development through increased dexterity. The onset of PHV is known as the optimal window where accelerated progress can be made in the five ?S?s?, Stamina, Strength, Speed, Skill and Suppleness. During this period the athlete can cope with an increase in training volume however due regard must still be given to recovery and regeneration elements in the programme.

PAV

Peak Aerobic Velocity. During this stage the adaptation of the aerobic system to aerobic training is accelerated.

VO2 Max

VO2 max increases significantly after the onset of PHV.

Speed 1 and Speed 2

These two windows show the peak improvements in rate of movement. The first window is caused by a rapid improvement in the function of the central nervous system. The second window corresponds to the improvements in physiology, i.e. VO2 max.

Skills

The window for peak improvement in skills is not the only time when skills can be developed but it is the time when skills are developed the fastest.

Training Considerations - Changes at Puberty

http://concept2.co.uk/training/guide/changes_at_puberty

Whilst we all know that it will happen it is, never the less, a shock when puberty arrives, not just for the adolescent but also those around them. For this reason it is important for the coach or adult responsible for training that they understand the physiological changes that take place and are able to construct the training programme appropriately.

Growth Spurt

The adolescent growth spurt through puberty may increase height by up to 6? (15cm) or more. The spurt starts between 10 and 12 in girls, 12 and 14 in boys (but may start earlier or later in both). For a while girls may be bigger and stronger than their male peers. Before puberty 66% of growth is in legs; after, 60% is in trunk. Early maturers do well in age-group sport but may drop out later, as others catch them up.

Bones

After the growth spurt, girls have a broader pelvis, boys have broader shoulder girdles and longer arms - all relative to body size. The valgus angle (angle in elbow) in girls may interfere with throwing, and it makes the elbow susceptible to injury, e.g. javelin throwing.

Body Fat

Until the growth spurt, both sexes are fairly equal at about 16-18% body fat, then the boys lose fat to about 12-15% through adolescence and the girls gain it to about 21-25%, by 17. This fat difference penalises the girls in many sports, but may be an advantage in some swimming events.

Cardio-respiratory

Maximal adult heart rates tend to be around 200 bpm, but children may reach 20-25 beats higher, at lower blood pressures. Children have relatively higher respiratory rates than adults, and their Ventilatory Equivalent (VE) for oxygen is higher. The VE is the volume of air ventilated to give an oxygen intake of one litre. At 8 years old the VE may be 38 litres of air per litre of oxygen; by 18, this will have dropped to 28 litres. In young children this may predispose to hypocapnia, (a decreased level of carbon dioxide in the blood) with flexor spasms of hands and feet; treat by rebreathing via a paper bag.

Aerobic Power

Children are biomechanically and biochemically ?wasteful? of energy (as indicated by their higher VE). The oxygen costs of running and walking are relatively higher in children than in adults. For example, at 10km/hr the oxygen cost may be 47ml/kg at age of six, but only 38ml/kg at 17. In cycling, the energy costs are closer between younger and older children, as the mechanics of the cycle tend to even out the biomechanical differences.

Anaerobic Power

Even when normalised for body mass, the anaerobic energy produced by an 8-year old is about 70% of that at age 11, which in turn is less than a 14-year old. Children?s muscle contains less glycogen, it is utilised at a lower rate, and lower levels of lactic acid are produced. Thus young children don?t have the lactate fatigue barrier of adults.

Strength

With respect to strength, muscle forms a much lower percentage of body mass before puberty - e.g. 27% compared to 36-44%. Strength training, especially in boys, is more effective after puberty.

Thermoregulation

An 8-year old may have a body surface area/body mass ratio nearly 40% greater than an adult. This can lead to greater rates of heat absorption in the sun, or of heat loss in cold water. Sweat rates before puberty may be around 350-450ml/m2/hour compared to between 600-800ml/m2/hour after puberty.

Voluntary Dehydration

Especially in children, thirst tends not to match water loss over a few hours, as in exercise and sporting situations. Drink stops should be programmed.

Exercise Perception

At equivalent levels, children perceived exercise as being much easier than adults. Thus it is easy to overwork children in sports training situations.