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**Resistance Training for Children and Youth:
A Position Stand from the Australian Strength and
Conditioning Association (ASCA)
2007**

PART ONE



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1.0. INTRODUCTION TO RESISTANCE TRAINING FOR CHILDREN AND YOUTH

The use of resistance training by children (6-12 years) and youth (13-18 years) has been an area of controversy for the past 30 years. Much research has been directed to this area during this time and a number of prestigious organisations such as the American Academy of Pediatrics (AAP); the US National Strength and Conditioning Association (NSCA), and the British Association of Exercise and Sport Sciences (BASES) have developed Policy Documents or Position Stands to summarise the research performed in the area and provide guidance for coaches, parents and teachers (AAP 2001; NSCA 1996; BASES 2004). These Position Stands are remarkably thorough scientific documents, for example the NSCA Position Stand references 145 publications; while the BASES Position Stand was developed by a group of experts consisting of orthopaedic clinicians, physical educators, sociologists, exercise physiologists, psychologists and biomechanists. However, the practical recommendations that were developed in these documents are typically very general and do not provide a great deal of specific guidance for the coach, parent, athlete or teacher. For example, in the AAP 2001 Policy Document one of the main recommendations is:

“A general strengthening program should address all major muscle groups and exercise through the complete range of motion.” (AAP 2001 p 1471).

While such advice is undoubtedly correct these types of general statements provide little real clarity for the coach in developing a comprehensive resistance training program for children and youth. The purpose of the Australian Strength and Conditioning Association (ASCA) Position Stand is to develop a document that provides for as much clarity and guidance as possible to assist coaches in designing resistance training programs for children and youth at various stages throughout their development. Hence this document develops a number of age related sample programs, proposes age and function specific progressions in training, and describes the actual first hand experiences of highly trained athletes who have performed intense resistance training during their youth. The Position Stand is divided into 7 sections dealing with each aspect of the training process including:

1. The appropriate age to commence training – how young is too young?
2. Training intensity – how heavy is too heavy?
3. Program design for the 6-9; 9-12; 12-15; and 15-18 years of age groups including model programs and recommended muscular function prerequisites prior to progression to more advanced programs.
4. Injuries, how they are caused, appropriate lifting technique and injury prevention strategies.
5. Legal cases involving weight training and children.
6. Nutrition and recovery strategies to enhance training effectiveness in children and youth.
7. Overall summary of the ASCA recommendations.

Hence this Position Stand develops very specific recommendations to serve as examples. However, it is acknowledged that all cases are individual and hence while very specific recommendations are given, individual variation for any specific individual will be required by the strength and conditioning coach (SCC) who is dealing with that specific child. The ASCA Position Stand is largely based on the results of published research with the addition of the real world first hand training experiences that have been reported by the ASCA membership and members of the ASCA Advisory Panel and Board.



2.0. THE APPROPRIATE AGE TO COMMENCE RESISTANCE TRAINING

2.1. How young is too young?

One question that is often asked of the ASCA is how young can a boy or girl start performing resistance training? One of the most comprehensive long-term research studies on children performing resistance training was conducted in Israel by Sadres and colleagues (2001). These researchers studied the effects of progressive resistance training on 27 boys aged between 9 and 10 years (mean 9.2 ± 0.3 yrs) over 2 school years (21 months, including 18 months of supervised training with 3 months of holidays in between the school years where no supervised training was performed) and compared the effects against a control group of 22 similar boys who did not perform resistance training but participated in standard physical education classes including track and field, basic gymnastics and ball games (e.g. soccer, basketball etc). Each group performed their activities twice per week for approximately 1 hour per session. The resistance training was designed and instructed by a weightlifting coach and consisted of classic weight lifting exercises such as clean pulls, jerk, clean, squats, dead lift, snatch and snatch pulls as well as a few isolated exercises involving leg and arm flexion and extensions in addition to abdominal exercises and back extensions. Each resistance training session consisted of 150 repetitions per session using between 3 to 6 exercises for 5 to 30 repetitions of 1 to 4 sets per exercise. In the first school year (9 months) the load varied from 30 to 70% of maximum with a mean of 50%; while in the second school year the intensity was increased from 50 to 70% of maximum with a mean of 60% maximum. The resistance trained group recorded similar increases in body height and weight to that achieved by the control group over the 21 month period, however, the increases achieved in strength were significantly greater and were of the order of a about a 1% increase in strength per week.

Only one injury was reported during the 21 month study and was described as follows:

“... on one occasion the bar slid and fell on the thighs of one of the subjects following a lift (clean). The child complained of transient non-specific pain in the anterior thigh and sat out for about 5 min. He returned to train within the same session when the pain was resolved and had no further complications. Therefore, it was felt that no additional medical evaluation was required. The calculated injury rate was 0.055/100 participant-hours.” (Sadres et al., 2002 p 363).

An important feature of this study was the high degree of expert supervision, and logical progressions that were provided throughout the training period. To commence the program the initial load consisted of a broom stick for the first month, followed by an 8 kg bar for the following month in order to learn the proper technique and safety procedures. The study clearly demonstrated that advanced resistance training can be safely and effectively employed in 9 year old boys.

In specifically addressing the question of how young is too young, researchers Falk and Mor (1996) reported positive results from resistance and martial arts training in 6-8 year old boys. Faigenbaum et al. (2003) conducted a study with 32 girls and 64 boys between the ages of 6-12 years that demonstrated that 1 RM (repetition maximum) testing using child-sized weight machines was safe and effective. Avery Faigenbaum from the University of Massachusetts in Boston is perhaps the most prolific researcher in this area. In a review paper entitled: “Resistance training for Adolescent Athletes” he stated:

“Although there is no minimum age requirement for participation in a youth resistance-training program, all participants should have the emotional maturity to accept and follow direction and should genuinely appreciate the potential benefits and risks associated with youth strength training.” (Faigenbaum, 2002 p 32).



To take an extreme example, many readers may well have seen pictures and interviews with child body building prodigy Richard Sandrak www.richardsandrak.com who commenced weight training using light dumbbells under the supervision of his father at the tender age of 3. By the age of 7 Richard was a well known celebrity within the bodybuilding community and regularly performed guest posing routines at major competitions and was featured on a number of television shows including "Ripley's Believe it or Not" and possessed an extremely lean muscular body. At this stage he was reportedly performing grueling multiple hour gym sessions on a daily basis under his father's supervision and displayed remarkable determination and focus.

2.2. Position of the ASCA on appropriate training age

If a child is ready to participate in organised and structured sports such as cricket, football, rugby, basketball, then they are generally ready to perform a supervised resistance training program. As children typically enter formal school at the age of 6 years they may be ready to participate in an organised resistance training program at this time. However, the actual age will vary from child to child and will be largely based on their capacity to follow clear directions. Some children at this stage of development may well see the weights area as a big playroom to run around and swing off the equipment etc and do not have the focused attention span or commitment to apply to training or follow clear directions and are simply not ready for resistance training. *One factor to keep well in mind is that a standard gym is a very dangerous place for young children filled with all sorts of weights, plates, and machines, which are all potentially very hazardous for young children.* As will be detailed in the injury section, many injuries occur to children in gyms from dropping weights on fingers or toes, hitting their heads on bars. Hence prior to commencement of a resistance program the child will be required to be strictly supervised and able to follow clear directions, and understand basic safety considerations. While the age that this occurs will vary from child to child it is the **position of the ASCA that the youngest a child should commence resistance training is at 6 years of age.**

3.0. TRAINING INTENSITY

3.1. How heavy is too heavy?

Perhaps the most controversial questions pertaining to resistance training for children are *how heavy is too heavy, what is an appropriate training load, and what type of exercises and loadings are appropriate at various stages of childhood?* The Policy Statement from the AAP is quite clear on this topic and recommends:

"Preadolescence and adolescence should avoid competitive weight lifting, power lifting, body building and maximal lifts until they reach physical and skeletal maturity." (AAP 2001 p 1471)

The policy statement goes on to suggest that:

"Progressive resistance exercise requires the successive completion of 8 to 15 repetitions in good form before increasing weight or resistance" (AAP 2001, p 1471).

The Position Stand from the NSCA is a little more tolerant to the performance of maximal lifts. In their Position Stand it is stated that:

"The examination of the relative safety of supervised 1-RM testing in laboratory settings performed only to evaluate training-induced changes in muscular strength should be supported philosophically. Most of the forces that children are exposed to in sports and recreational activities are likely to be greater in both duration and magnitude of exposure than competently supervised and properly performed maximal strength tests. Conversely, under no circumstances should children be subjected to unsupervised and poorly performed 1-RM testing (e.g., inadequate progression of loading and poor lifting technique) or chronic maximum resistance training (e.g., weightlifting training without periodization), due to the real risk of injury" (NSCA 1996 p 65-66).



Nevertheless the NSCA overall recommendations suggested that:

“Depending on the goal of the training program (i.e., strength or local muscular endurance), 1 to 3 sets of 6 to 15 reps performed on 2 or 3 nonconsecutive days a week is recommended.” (NSCA 1996 p 71).

The American College of Sports Medicine (ACSM) in a Current Comment paper entitled “Youth Strength Training” stated:

“Strength training with maximal weights is not recommended because of the potential for possible injuries related to the long bones, growth plates, and back.” (Faigenbaum & Micheli, 1998 p 2).

3.1.1. Maximal lifts in youth athletes

Despite these recommendations for youth to avoid the performance of maximal lifts, the Australian Powerlifting and Weightlifting Federations continue to sanction maximal 1 RM sporting competitions for youth. For example, the Australian Powerlifting Federation has current records for boys and girls for the 14 to 18 age groups (sub-junior class) with some of the boys performing squats and deadlifts in excess of 250 kg, while one of the girls performed 150 kg in the squat and 155 kg in the deadlift (see www.powerliftingaustralia.homestead.com for details). The federation also has school bench press records for various age categories including under 14, under 15 and under 16 age categories for both boys and girls divisions, with one of the under 14 boys lifting 85 kg and one of the under 14 girls lifting a whopping 75 kg bench press. Similarly, the Australian Weightlifting Federation has current records for both boys and girls in the under 16 and under 18 age classes, with some of the under 16 boys performing the clean and jerk lift with 150 kg, while one of the under 16 girls performed the clean and jerk with 92 kg (see www.awf.com.au for details).

Perhaps the best way to examine what happens to youth when repeatedly lifting maximal loads is to consider the effects of the sports of Powerlifting and Weightlifting. Byrd et al. (2003) examined the performance and rate of injury in 3 female and 8 male elite junior weightlifters who were training at the USA Weightlifting Development Centre in Louisiana for several years. At the commencement of the program the athletes mean ages were around 13 years of age with the youngest competitor a 9 year old male. In their first competition their maximal clean and jerk lifts were on average around 35 kg progressing up to about 85 kg after several years of consistent training using loads that varied from 3 sets of 10 at 60-75% maximum during the general training phase up to 5 sets of 3 reps at 75-90% of maximum during the competition phase. The 9 year old boy clean and jerked 25 kg in his first competition and after 2 years of consistent training completed a 45 kg lift at 11 years of age. During the competitions maximal loads would be attempted. Byrd et al. (2003) reported that throughout the duration of the study:

“There were 534 lifts in competition, not counting fairly heavy lifts during warm-up, with no injuries that required medical attention and no loss of training time for this population. In addition, for this population there were no injuries in training that required medical attention or that resulted in loss of training time.” (Byrd et al., 2003 p 139).

One very important consideration that needs to be taken into account from this study was the precise nature of the training performed and the high level of expert supervision that was available to the athletes. Technique was the first priority with children commencing with wooden sticks and no resistance work was done until there was a clear understanding and progress in technique. The children were steadily progressed in their training with the plan of having each child ready to compete in a local weightlifting event after about two to three months of consistent training.

Similar results have also been reported by Rielly et al. (2002) (cited in Byrd et al. 2003) who followed 20 slightly older weightlifters (mean age 14.6 ± 1.9 years) for their final 8 weeks of preparation for the US National Junior Weightlifting Championships and reported only 0.9 injuries per 1000 hours of participation. A similar value of 0.8 was reported for weightlifters by Risser et al. (1990). However, the sport of Powerlifting has been reported to have a much higher injury rate of 13.8, with muscle strain to the lower back being the most common reported injury (Brown and Kimball, 1983). The higher incidence of injury in the sport of Powerlifting may well be due to the heavier weights lifted in this sport in comparison to Weightlifting as well as the lack of qualified coaching in the sport of Powerlifting in comparison to Weightlifting. Many individuals can perform the squat, bench press and deadlift exercises with little or no coaching and the technique used in the lifts, especially maximal squats and deadlifts, can be very poor. However, the highly technical nature of the clean and jerk and snatch lifts means that the vast majority of weightlifters have competent coaches to assist them in their training. Of the 98 injuries sustained by the adolescent power lifters in the survey conducted by Brown and Kimball (1983) 50% were to the lower back, 18% to the upper extremity, 17% to the lower extremity and 14% to the trunk. This injury rate value of 13.8 is much higher than that reported for other youth sports.

Recently the Centre for Disease Control (CDC) in the US commissioned a study of the injury rate in high school sport and reported:

“An estimated 1,442,533 injuries occurred among U.S. high school student athletes participating in practices or competitions for the nine sports studied. The overall (i.e., practice and competition) injury rate in all sports combined was 2.44 injuries per 1,000 athlete exposures. Football had the highest injury rate (4.36 injuries per 1,000 athlete exposures) followed by wrestling (2.50), boys' (2.43) and girls' (2.36) soccer, and girls' basketball (2.01). Boys' basketball, volleyball, baseball, and softball each had injury rates of less than 2.0 injuries per 1,000 athlete exposures. In each sport, the injury rate was higher in competition than practice settings.” (CDC 2006).

3.1.2. Training with maximal lifts: Anecdotal experience

Published scientific research is generally the gold standard by which information is accepted as legitimate within our society. However, in addition to this data it is also useful to consider the actual first hand experiences of athletes who have trained intensely with weights throughout their youth and who are prepared to reflect upon their experiences in later life. Such information may well reveal factors that were not present during the early lifting years but emerged later in life. The membership of the ASCA were contacted and asked to briefly relate their first hand experiences on this matter and one particularly interesting account is summarized below.

Power lifter Greg Wilson commenced intense weight training at 13 years of age and competed in his first junior (u/20) national Powerlifting championships in 1981 in the 67.5 kg weight class winning the division with a 165 kg squat, 105 kg bench press and a 195 kg deadlift at 15 years of age. Two years later with consistent heavy training in 1983 Greg again won the junior National Powerlifting championships in the 90 kg weight class lifting a 235 kg squat, 152.5 kg bench press and 260 kg deadlift at 17 years of age. Later that year Greg herniated his lower spine while deadlifting. The back injury settled down and Greg continued to compete throughout his teenage years finishing his lifting career at the 1990 WA State Powerlifting Championships with a 320 kg squat; 225 kg bench press and 320 kg deadlift lifting in the 110 kg weight class. At this stage, at the age of 24, Greg's body was so riddled with injuries that he no longer competed. Now in his 40's Greg still trains with weights and often has soreness in his lower back, elbows, and knees. He remembers his Powerlifting days with fondness but wishes with the benefit of hindsight that he commenced competing in Powerlifting once he had reached skeletal maturity at the age of about 18 years, rather than at 13 years of age. Greg still feels that it is a good idea to train with weights at 13 years of age but would have been better to do body building type training with lighter weights (60-80% maximum) for more repetitions (6-12) and avoided maximal lifts, especially for the squats and deadlifts. Greg feels such an approach may have avoided many of the injuries that he endured, enabled him to compete for longer in Powerlifting, but still allowed him the benefits of training during the adolescent growth spurt from 15 to 17 years when he experienced the best gains in size and strength throughout his lifting career. Greg also feels that he should have spent more time performing flexibility work during his youth as his body is quite stiff now and is relatively unresponsive to flexibility training at this later time.



3.2. Safely estimating maximal strength

It is the **position of the ASCA that young and less experienced, school-aged resistance trainers can have their strength capabilities assessed by performing testing with lighter resistances and performing a “repetitions till fatigue” (RTF) test**, from which 1-RM (or any RM up to 20 RM) can be extrapolated with reasonable accuracy (Baker, 2004). The RTF protocol involves performing the maximum number of repetitions of a specified exercise until the exercise can no longer be performed with sound technique. This testing may take place after a certain period of time has been used to develop sound technique (e.g., 1-4 weeks) but also should only take place if the younger athlete displays sound physical characteristics as proposed by Giles (2006). For example, it would seem futile to assess “squat strength” with any extra barbell resistance in a young athlete who does not possess adequate neuromuscular control in an unloaded version of the exercise.

The RTF testing procedure allows a coach to assess strength by using a standard light resistance (e.g., 40 kg for the bench press for males and 15 kg for females) that all or most athletes use and their individual strength scores are extrapolated based upon how many repetitions are performed with that resistance. If for example, one athlete lifted 40 kg for 9 repetitions then their estimated 1-RM would be 40 x conversion factor of 1.22 = 48.8 kg (see Table 1). If another athlete lifted 40 kg for 12 repetitions then their 1-RM would be 52.4 kg (40 kg x conversion factor of 1.31 = 52.4 kg) (see Table I for corresponding conversion factors for different repetitions).

When implementing these tests, technique should be emphasized at all times and the test terminated when the athlete cannot maintain proper technique. The table that younger athletes use is different to that for experienced resistance trainers, as younger athletes do not possess the same intramuscular control as more experienced athletes and accordingly, this lack of coordination means they cannot perform well with heavier resistances. Accordingly for younger athletes, a resistance should be chosen that allows at least eight repetitions, so that emphasis is placed on technique development.

It has been proposed that this type of testing suits younger and school-age athletes because it is more time efficient de-emphasizes the use of heavy weights and the risks accompanying their use for athletes not experienced in heavy lifting, while still allowing for the generation of data concerning athletes’ capabilities in key exercises (e.g., Chin-ups, bench press, squat) (Baker, 2004). The extrapolated RM scores can be used to individually determine if each young athlete is lifting resistances appropriate to their strength and neuromuscular control capabilities.

Table I – Determining 1-RM from Varying Repetitions

| | | | | | | | | | | |
|---------------|------|------|------|------|------|------|------|------|------|------|
| % 1-RM | 100 | 96 | 94 | 92 | 90 | 88 | 86 | 84 | 82 | 80 |
| Reps | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| CF | 1.0 | 1.04 | 1.06 | 1.08 | 1.11 | 1.13 | 1.16 | 1.19 | 1.22 | 1.25 |
| % 1-RM | 78 | 76 | 74 | 72 | 70 | 68 | 66 | 64 | 62 | 60 |
| Reps | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| CF | 1.28 | 1.31 | 1.35 | 1.39 | 1.43 | 1.47 | 1.52 | 1.56 | 1.61 | 1.64 |

Guide for determining 1-RM from varying repetitions performed to maximum effort in novice and younger less experienced resistance trainers performing standard strength exercises. An estimate of 1-RM is made when the weight lifted is multiplied by the conversion factor according to the number of repetitions that were performed with that weight (Table developed by Dr. Dan Baker). Abbreviations: **% 1-RM** = percentage of one-repetition maximum; **Reps** = repetitions; **CF** = conversion factor.



3.3. Position of the ASCA on training intensity

There is an abundance of evidence to suggest that when appropriately performed resistance training is a safe and effective exercise to be engaged by children and youth. However, it would seem prudent for all children and most youth to avoid the performance of maximal lifts, especially maximal deadlifting. It is the **position of the ASCA that the following training loading intensities and exercise selection strategies be adopted when training children and youth:**

- **Level 1: 6-9 years of age:** modification of body weight exercises and light resistance (brooms and bands etc) work only for relatively high repetitions eg 15+ reps;
- **Level 2: 9-12 years of age:** 10-15 RM; (maximal loading approximately 60% maximum) using predominantly simple free weight exercises and machine exercises where the machine is an appropriate size for the child.
- **Level 3: 12-15 years of age:** 8-15 RM; (maximal loading approximately 70% maximum) using progressively more free weight exercises but avoiding complex lifts such as cleans, snatches, deadlifts and squats etc unless competent coaching is available from a coach with at least a Level 2 ASCA strength and conditioning accreditation.
- **Level 4: 15-18 years of age:** 6-15 RM; (maximal loading approximately 80% maximum) progressively moving towards an advanced adult program involving split routines where appropriate and complex multi-joint movements provided sound technique has been developed under competent coaching by a coach with at least Level 2 ASCA strength and conditioning accreditation.

The various levels and suggested age brackets will be discussed in more detail in the following section. The above maximal loading percentages relate to strength-based exercises (e.g., bench press) and not to velocity specific exercises such as medicine ball throws where higher percentages may apply. **The ASCA does not advocate the use of one-repetition maximum (1-RM) testing to determine appropriate training loads or to monitor progression in training for Levels 1-3. Instead the repetitions maximum (RM) method is recommended.**

For example, with Level 3, 12-15 years of age, the appropriate training load is between 8 to 15 RM. If the individual can perform 15 repetitions using good form with a given load then that load may be increased on subsequent sets. However, if the individual can not perform 8 repetitions with good form then a lower load is recommended for subsequent sets. One-repetition maximum testing may be appropriate in certain instances where elite young athletes (e.g., swimmers) have a well developed training background with competent coaching.



4.0. PROGRAM DESIGN AND PROGRESSION

In this section a number of sample programs will be presented and specific training recommendations be made for various age groups. This has been done to provide the reader with some clear direction in the development of youth resistance training programs. However, it is understood that each athlete is an individual and hence the reader should not necessarily simply use the programs exactly as written but see them as models to be modified, within sensible parameters, to the specific requirements of the individual athlete(s).

4.1. Research studies

Prior to developing specific resistance training programs for youth at various ages, it is useful to examine the effectiveness of the programs employed by researchers when studying youth resistance training. For example, Tsolakis and colleagues (2004) from the University of Athens examined the effects of a 2 month upper body resistance training program on nine 11-13 year old untrained boys. Over the 2 month period the subjects trained 3 times per week on non-consecutive days performing 6 upper body exercises for 3 sets of 10 RM with a 1 minute rest period between repeated sets and 3 minutes rest between exercises. The 6 exercises were all performed using variable resistance machines and consisted of supine bench press, wide grip cable pull-downs, biceps curl, triceps extension, seated row and overhead press. Total training time was approximately 1 hour per session and each subject had their 10-RM re-evaluated every 15 days to adjust training loads. No injuries were reported from the training and a few subjects complained of delayed muscle soreness after the initial 3 sessions of training. The training resulted in a 17.5% increase in isometric strength, and 124% increase in resting testosterone levels as measured in blood tests. These increases were significantly greater than that achieved by an age matched control group who did not participate in resistance training.

4.2. Long Term Athlete Development (LTAD)

In designing resistance programs for children the ASCA has been strongly influenced by the work performed by Dr Istvan Balyi (see Balyi, 1999) and Mr Kelvin Giles on long term athlete development. This work has developed a coherent structured plan for the progressive development of young athletes throughout their maturation process to maximize their sporting abilities while avoiding injury and burn out. Kelvin Giles was the key note presenter at the 2006 ASCA National Conference held on the Gold Coast and presented this topic and his work has been adopted in the development of the Level 2 coaching accreditation course materials for the ASCA.

In essence the process of long term athlete development follows a series of age and function related progressions whereby child athletes perform progressively more complex and intense training as they age and become capable. The ASCA proposes the following stages in the resistance training for children and youth:

- Level 1: 6-9 years of age:
- Level 2: 9-12 years of age:
- Level 3: 12-15 years of age:
- Level 4: 15-18 years of age:



The overlap in age between the 4 levels (i.e., a 9 year old may be in Level 1 or Level 2) reflects the fact that different children will mature at different rates and thus may well progress at various times. Further, in addition to chronological age, the progression between levels is also muscular function dependent. For example, prior to progressing onto Level 2: 9-12 years of age the athlete should be at least 9 years of age and able to:

1. Hover in a horizontal position with feet, elbows and forearms touching the ground and straight back position for 60 s.
2. Perform 10 well controlled back extensions to horizontal.
3. Perform 10 well controlled full range double leg squats with hands behind the head and feet flat on the floor.
4. Perform 10 well controlled push ups off their toes chest to touch the ground and arms achieve full extension.
5. Perform 5 well controlled lunges each leg with back knee touching the ground and good balance.
6. Wall squat at 90 degrees for 60 s.
7. Touch their toes in the sit and reach test.

Hence an 11 year old just starting out with resistance training would be encouraged to commence in the 6-9 years old category i.e. Level 1 using modified body weight and light resistance exercises only until they can perform the above exercises and then progress to the 9-12 year old category i.e. Level 2 when this has been achieved. **In this way the various categories are age related but also muscular function dependent, with the main emphasis of the training period being the achievement of the set physical competencies for that chronological age group.** However, an 8 year old child who can fulfill all the above functional tests would still be encouraged to continue to perform body weight and light resistance training only until they turn 9 and then progress to Level 2.

Prior to commencing Level 3: 12-15 years of age the athlete should be at least 12 years of age and able to:

1. Satisfy the requirements for Level 2.
2. Hover in a horizontal position with feet, elbows and forearms touching the ground and straight back position for 90 s.
3. Perform 10 well controlled repetitions of barbell bench press using a load of 40% of body weight.
4. Perform 10 well controlled repetitions of dumbbell rowing using a load of 15% of body weight in each hand.
5. Perform 10 well controlled pull ups with legs out straight using an underhand grip.
6. Perform 10 well controlled lunges each leg with back knee touching the ground and good balance holding a load of 10% of body weight in each hand.
7. Reach 5 cm beyond their toes in the sit and reach test.

Prior to commencing Level 4: 15-18 years of age the athlete should be at least 15 years of age and able to:

1. Satisfy the requirements for Levels 2 and 3.
2. Hover in a horizontal position with feet, elbows and forearms touching the ground and straight back position for 120 s.
3. Perform 5 well controlled full range single leg squats each leg.
4. Perform 10 well controlled parallel bar dips for boys and 10 bench dips for girls with legs out straight.
5. Perform 10 well controlled chin ups for boys and a 30 s arm hang at 90 degree elbow angle for girls (underhand grip).
6. Perform 10 well controlled repetitions of barbell bench press using a load of 70% of bodyweight for boys and 50% of body weight for girls.



The above muscular function performance criteria are based on a “normal” standard sized individual. It is recognized that certain individuals in sports such as basketball or rowing often are exceptionally tall or heavy and thus these individuals may have difficulty performing some of the task (e.g., 10 chin ups) due to their size and in such cases a modified performance criterion would be appropriate.

The ASCA recognizes that resistance training programs are implemented for achieving different outcomes such as improvements in:

1. Body and limb control and joint stability
2. Hypertrophy of muscle and general strength
3. Maximal strength
4. Power and
5. Strength-endurance

It is the ASCA position that children and youth in the first 3 stages (i.e., Levels 1-3) benefit most from programs that improve body/limb control and joint stability. These programs would also inadvertently improve other outcomes (e.g., strength-endurance, general strength) without specific training for those outcomes. With a solid foundation of training emphasizing body/limb/joint control and stability and technical mastery during resistance exercises, athletes entering the fourth stage (i.e. Level 4) may more safely embrace training aimed at improving other resistance training outcomes. Consequently, the sample programs and guidelines provided heavily emphasize this philosophy of LTAD.

4.3. Model Programs

In this section a number of model programs for Levels 1, 2, 3 and 4 will be outlined. It is not intended that these programs be the only programs allowable for children or youth to use and modifications to the programs will be required depending upon the individual characteristics of the children, training goals, available equipment, training time etc. However, model program are developed to serve as useful examples from which individual specific training programs may be developed and employed. It is the **position of the ASCA that all programs performed by children must be strictly coached by an adult(s) and that the adult be accredited with at least a Level 1 ASCA Strength and Conditioning coaching accreditation and to coach youth in level 3 and 4 in the more complex lifts a coaching accreditation of at least a ASCA Level 2 would be required with a preference for such coaches to be moving towards the ASCA Pro Structure. Further, when supervising groups of children the ratio of coaches to children is recommended to be 1 coach for every 10 children and that the children receive comprehensive instruction on relevant safety issues prior to the commencement of training.**

4.3.1. Level 1: 6-9 years

As previously outlined Level 1 programs are designed for young children 6 to 9 years of age or any older child who is just starting out in resistance training and conditioning. Appropriate programs involve modified body weight type exercises and light resistance work performed for relatively high repetitions eg 15+ reps. The goal over this period is to have the children become accustomed to regular training, develop basic fitness abilities such as strength, muscular endurance, cardiovascular endurance, co-ordination and flexibility in a safe, low stress, fun environment. The specific muscular function goals during this period are:

1. Hover in a horizontal position with feet, elbows and forearms touching the ground and straight back position for 60 s.
2. Perform 10 well controlled back extensions to horizontal.
3. Perform 10 well controlled full range double leg squats with hands behind the head and feet flat on the floor.
4. Perform 10 well controlled push ups off their toes chest to touch the ground and arms achieve full extension.
5. Perform 5 well controlled lunges each leg with back knee touching the ground and good balance.
6. Wall squat at 90 degrees for 60 s.
7. Touch their toes in the sit and reach test.



A beginning program would comprise a basic 3 day per week circuit type whole body program performed on alternate days (i.e. Monday, Wednesday and Friday) of the following exercises:

- > Basic warm up (5 minute jog or cycle etc plus 2-3 minutes of dynamic stretching)
 1. Step ups (both left and right legs) (quadriceps, hamstring and gluteal muscles) - 20 to 30 cm step or chair
 2. Push ups (pectorals, deltoid and triceps brachii muscles) - off knees initially progressing onto toes as strength increases.
 3. Star jumps (quadriceps, adductors, gluteal muscles).
 4. Abdominal crunches (abdominals and hip flexors) - as strength increases progress towards bent legged sit ups.
 5. Chair dips (triceps brachii muscle) - initially have legs close to the chair and use the legs and arms to raise the body. As strength increases progressively move legs further away from the chair.
 6. 90 degree wall sit (quadriceps and gluteal muscles).
 7. Reverse back extensions (lower back, gluteal and hamstring muscles) - lying face down with torso over table or bench and lift legs to level of hips hold top position for 1-2 s and repeat.
 8. Hover (abdominal, hip flexor and lower back muscles) - initially off knees progressing to toes.
- > Cool down and stretch - (5 min jog or cycle etc and 5 minutes of stretching)

Progression:

Week 1: Perform 20 s of each exercise for as many controlled repetitions as possible followed by 40 s rest and then move onto the next exercise. Perform 1 circuit - total workout time approximately 25 minutes (including warm up and cool down). Once this circuit is comfortably achieved by the athlete progress onto stage 2.

Stage 2: Perform 30 s of each exercise for as many controlled repetitions as possible followed by 40 s rest and then move onto the next exercise. Perform 1 circuit - total workout time approximately 27 minutes (including warm up and cool down). Once this circuit is comfortably achieved by the athlete progress onto stage 3

Stage 3: Perform the same as stage 2 but repeat the circuit 2 times - total workout time approximately 38 minutes. Once this circuit is comfortably achieved by the athlete progress onto stage 4.

Stage 4: Perform 2 circuits but increase exercise time to 40 s per exercise with 50 s recovery - total workout time approximately 40 minutes. Once this circuit is comfortably achieved by the athlete progress onto stage 5.

Stage 5: Perform 2 circuits but increase exercise time to 50 s per exercise with 50 s recovery - total workout time approximately 43 minutes. Once this circuit is comfortably achieved by the athlete progress onto stage 6.

Stage 6: Perform 2 circuits but increase exercise time to 60 s per exercise with 60 s recovery - total workout time approximately 47 minutes.

At this stage the athlete can keep the same circuit but try and increase the intensity of some of the exercises. For example, some options include:

- > Increasing the step height for the step ups
- > Push ups off toes rather than knees
- > Progress from crunches to bent legged sit ups
- > Chair dips performed with legs progressively further from the chair
- > Hover off toes rather than off knees

Increase the intensity progressively by gradually including these changes. For example, initially the first 30 s of the hover may be performed off the toes with the remaining time off the knees etc. Conversely, there may be some particularly heavy children who are unable to perform 20 s of push ups off their knees and for these children modifications such as the performance of push up off a wall or bench will be initially more appropriate.

Over time, with continued adaptation, additional exercises may be added or substituted such as:

- > Lying pull ups performed from under a small table or off a low bar (e.g., smith machine bar)
- > Isolated DB exercises such as DB arm curls, triceps kickback, lateral raises
- > Lunges
- > DB Squats
- > Normal back extensions instead of reverse back extension

However, in all cases workouts should be limited to 3 whole body routines per week performed on alternate days for a duration not exceeding 1 hour in total. Hence towards the end of the Level 1 period a typical program may involve the following exercises:

Basic warm-up and dynamic stretching - 10 minutes

1. Step Ups (both left and right legs) (quadriceps, hamstring and gluteal muscles)
2. Push Ups (off toes) (pectorals, deltoid and triceps brachii muscles)
3. Star Jumps (quadriceps, adductors, gluteal muscles)
4. Sit Ups (abdominal and hip flexor muscles)
5. Lunges (both left and right legs) (quadriceps, hamstring, gluteal muscles)
6. Lying Pull Ups (upper back and biceps)
7. Standing Squats with light (2-3 kg) DB (quadriceps and gluteal muscles)
8. Chair Dips (triceps brachii muscle)
9. Back Extensions (lower back, gluteal and hamstring muscles)
10. Hover (abdominal, hip flexor and lower back muscles)

Cool down and stretch - 10 minutes

- 60 s work and 60 s rest for 2 circuits - total workout time approximately 60 minutes.

There are many variations that could be done to the above program. The use of time rather than a prescribed repetition number has been employed as it is often easier to co-ordinate and focus children, especially when in a small group, to a time of exercise rather than a repetition number. Have them focus on performing controlled repetitions rather than rush to get to a particular repetition number. Further, the above programs have been developed with minimal equipment requirements so that they may be adopted by the greatest number of children who may not have access to specialized resistance training equipment and can perform the exercises from home or in a school classroom.

4.3.2. Level 2: 9-12 years

At level 2 the programs begin to incorporate some free weights and machine weight exercises as well as body weight activities. Again it is essential that the programs adopted be strictly supervised by an adult with at least a Level 1 ASCA Strength and Conditioning accreditation and the machines used be an appropriate size for the children. A beginning program for level 2 would comprise a basic 3 day per week whole body program performed on alternate days (i.e., Monday, Wednesday and Friday) of the following exercises:

Basic warm up (5 minute jog or cycle plus 2-3 minutes of dynamic stretching)

1. Lunges (initially using body weight but progressing to include light dumbbells when appropriate)
2. Machine Leg Press
3. Barbell Bench Press
4. Wide Grip Lat Pulldown to the Front
5. Dumbbell Row
6. Back Extensions
7. Triceps Pushdown
8. Dumbbell Arm Curl
9. Hanging Knee Raises

Cool down and stretch – 10 minutes

The repetition range is between 10 to 15-RM with a maximal loading of 60% of the 1-RM. Initially the program should commence with 1 set of each exercise with 1-2 minutes rest between exercises, progressively building up to 3 repeated sets with 1-2 minutes rest between sets, as the child advances and can readily tolerate the increased training volume.

The goal of the program is to progressively develop the physical capacities of the children to be capable of achieving the following list of physical competencies at the age of 12:

1. Satisfy the requirements for Level 2.
2. Hover in a horizontal position with feet, elbows and forearms touching the ground and straight back position for 90 s.
3. Perform 10 well controlled repetitions of barbell bench press using a load of 40% of body weight.
4. Perform 10 well controlled repetitions of dumbbell rowing using a load of 15% of body weight in each hand.
5. Perform 10 well controlled lying pull ups with legs out straight using underhand grip.
6. Perform 10 well controlled lunges each leg with back knee touching the ground and good balance holding a load of 10% of body weight in each hand
7. Reach 5 cm beyond their toes in the sit and reach test.



4.3.3. Level 3: 12-15 years

At level 3 the programs begin using progressively more free weight exercises but avoid complex lifts such as cleans, snatches, deadlifts and squats etc unless competent coaching is available from a coach with at least a Level 2 ASCA strength and conditioning accreditation. Again it is essential that the programs adopted be strictly supervised by an adult with at least a Level 1 ASCA Strength and Conditioning accreditation and the equipment used be an appropriate size for the children.

A beginning program for level 3 would comprise a basic 3 day per week whole body program performed on alternate days (i.e., Monday, Wednesday and Friday) of the following exercises:

Basic warm up (5 minute jog or cycle etc plus 2-3 minutes of dynamic stretching)

1. Front barbell squats
2. Step ups holding dumbbells
3. Barbell bench press
4. Chin ups – initially using a close grip and restricted range of motion but progressing to a full range of motion as strength develops
5. Back extensions – with a 2 s pause at top
6. Hanging leg raises or Inclined sit ups
7. DB seated overhead press
8. Parallel bar dips or Bench dips if not sufficiently strong to perform 8 repetitions
9. Hover – Circuit: 60 s 2 arms to front and 30 s 1 arm each side (side hover)
10. Barbell Arm Curls

Cool down and stretch – 10 minutes

The repetition range is between 8 to 15-RM with a maximal loading of 70% of the 1-RM. Initially the program should commence with 2 sets of each exercise with 1-2 minutes rest between sets, progressively building up to 4 repeated sets as the youth advances and can readily tolerate the increased training volume. Towards the end of level 3 the youth may start employing pyramid loading where the loading can be increased on subsequent sets with a lighter drop set employed for the final set.

For youth wishing to pursue a sporting career in a strength or power based sport such as any of the rugby or football codes, track and field, swimming etc it is recommended that during this level the inclusion of some of the more complex and/or explosive exercises such as clean and press, squats, and deadlifts into the program be commenced and that competent instruction from a strength and conditioning coach with at least Level 2 accreditation be employed to instruct the athlete.

The goal of the program is to progressively develop the physical capacities of the children to be capable of achieving the following list of physical competencies at the age of 15:

1. Satisfy the requirements for Levels 2 and 3.
2. Hover in a horizontal position with feet, elbows and forearms touching the ground and straight back position for 120 s.
3. Perform 5 well controlled full range single leg squats each leg.
4. Perform 10 well controlled parallel bar dips for boys and 10 bench dips for girls with legs out straight.
5. Perform 10 well controlled chin ups for boys and a 30 s arm hang at 90 degree elbow angle for girls (underhand grip).
6. Perform 10 well controlled repetitions of barbell bench press using a load of 70% of bodyweight for boys and 50% of body weight for girls.



4.3.4. Level 4: 15-18 years

At level 4 the programs are progressively moving towards an advanced adult program involving split routines where appropriate and complex multi-joint movements provided sound technique has been developed under competent coaching by a coach with at least Level 2 ASCA strength and conditioning accreditation. The repetition range is between 6 to 15 RM with a maximal loading of 80% of the 1 RM.

A beginning program for level 4 would comprise a basic 3 day per week whole body program performed on alternate days (i.e.. Monday, Wednesday and Friday) of the following exercises:

Warm up – 10 mins on bike

1. Major chest exercise (Bench press, Incline bench press or DB press)
2. Overhead shoulder press (Clean and press, Standing military press or Seated press behind neck)
3. Upper back exercise (Chins, Lat pull or DB pullover)
4. Triceps (Dips, Lying triceps extension or Triceps pushdown etc)
5. Major leg exercise (Squat, Leg press or Hack squat)
6. Lower back exercise (Deadlift or Back extension)
7. Hanging leg raise (holding light 1-3 kg medicine ball between legs when strong enough)
8. Major bicep exercise (Standing DB curls, EZ curls or Preacher curls)
9. Inclined sit ups or Hover circuit
10. Calf raises

Cool down and Stretch – 10 mins

Should change specific exercises throughout the week:

- Mon and Fri perform Barbell Bench Press, Wed Incline Bench Press
- Mon Clean and Press, Wed Standing military press, Friday Press behind neck
- Mon Chins, Wed DB Pullover, Fri Lat pulldown
- Mon Squat, Wed Leg Press, Fri Hack Squat
- Mon and Fri Deadlift, Wed Back Extension etc

The repetition range is between 6 to 15-RM with a maximal loading of 80% of the 1-RM. The program should consist of 3-4 sets of each exercise with 2-3 minutes rest between major exercises such as clean and press, squats, deadlifts and 1-2 minutes rest between sets for more basic exercises such as back extensions, sit ups. The youth is encouraged to employ pyramid loading techniques where the loading can be increased on subsequent sets with a lighter drop set employed for the final set. For youth wishing to increase training intensity, muscle strength and size and move towards a split routine towards the end of Level 4 the following training recommendations are provided:

2 Way Split Routine: After 12 months on the above whole body program the individual may choose to up the intensity and volume and move to a 2 way split routine. This involves splitting the body in 2 and performing each workout 2 times per week, thus 4 workouts per week. The ASCA preferred way to achieve this is to split the body into:

Day 1: Upper Body (Chest, Shoulders, Triceps, Upper Back and Biceps): Monday and Friday. Day 2: Lower Body (Legs, Lower Back and Stomach): Wednesday and Saturday

However, there are other methods to achieve this, for example push : pull split routines. By splitting the body in two more exercises can be performed per session and a more intense workout per body part achieved with longer to recover prior to the next session.



Example of 2 Way Split Routine

Monday and Friday - Upper Body (Chest, Shoulders, Triceps, Upper Back and Biceps)

Warm up – 10 mins on bike

1. Bench press
2. Inclined bench press or DB Flies
3. Standing push press
4. DB Lateral raises or Rear deltoid exercise
5. Chin Ups
6. DB Pullovers or Bench pull
7. Dips
8. Lying Triceps Extension
9. DB Twist and Turn Biceps Curls

Cool down – 10 mins stretching

- 3-4 sets of 6-15 reps with about 1-3 minutes rest between sets.

Wednesday and Saturday - Lower Body (Legs, Lower Back and Stomach):

Warm up – 10 mins on bike

1. Squats
2. Deadlifts or Cleans
3. Leg press
4. DB lunges
5. Leg Curls
6. Back Extensions with additional loading
7. Calf Raises
8. Russian twists with medicine ball or Inclined sit ups with rotation
9. Hanging leg raises with light medicine ball between legs

Cool down – 10 mins stretching

- 3-4 sets of 6-15 reps with about 1-3 minutes rest between sets.

At this stage the athlete should be adopting periodisation techniques for the major lifts (i.e. bench press, squats, cleans etc) with their resistance training to coincide with their sporting program. For example, if the athlete was simply interested in getting basically big and strong during a 12 week off-season program the following schedule may be of use:

1. 4 weeks of high volume and low intensity training performing 4 sets of 15-RM loads per exercise – followed by:
2. 4 week of moderate volume and intensity training performing 4 sets of 10-RM loads per exercise – followed by:
3. 4 weeks of low volume and high intensity training performing 4 sets of 6-RM loads per exercise.

At the end of the 12 week period the program could return to the 15 RM loads hopefully with the athlete considerably bigger and stronger than when they commenced the 12 week program.

4.4. Sample programs from ASCA members

Members of the ASCA and professional bodies (Basketball Australia; Queensland Academy of Sport), have provided resistance training programs for youth participating in different sports to be viewed as working examples (Appendix 1–6).



