ASCA
Position Stand

Resistance Training for Children and Youth

Resistance Training for Children and Adolescents: A Position Stand from the Australian Strength and Conditioning Association (ASCA).
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Presentation Outline

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

- **Previous Position Stands [NSCA 1996; AAP 2001; BASES 2004] – thorough academic documents**
  - However, the practical recommendations that were developed in these position stands are 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 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.
ASCA Position Stand

- The entire ASCA Position Stand and the PowerPoint slides for this presentation can be downloaded free of charge from the ASCA website:
  - [www.strengthandconditioning.org](http://www.strengthandconditioning.org)
- We encourage all ASCA members to use and apply this information and make others aware of it so that the area of resistance training for children and youth can be better understood.
2. The appropriate age to commence training – how young is too young?

- 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 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).
The appropriate age to commence training – how young is too young?

- If a child is ready to participate in organised and structured sports such as cricket, football, rugby, basketball etc 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 about this time.

- However, the actual age will vary from child to child and will be largely based on their capacity to follow clear directions.
3 Training intensity – how heavy is too heavy?

- 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).
Current Practices in Australia?

- 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).

- Is this really a good idea for such young athletes to be lifting such heavy weights?
Injuries from Powerlifting

- 98 injuries were reported by adolescent power lifters in a 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.

- The injury rate value of 13.8 injuries per 1000 athlete hours is much higher than that reported for other youth sports.

- In 2006 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.” (CDC 2006).
Safety of Weight Lifting

- Apart from competitive powerlifting, weight lifting and weight training are relatively safe activities.
- Rielly et al. (2002) followed 20 youth 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).
- These values are much lower than the average of 2.44 reported for other popular youth sports.
Anecdotal Experience: My Story

- 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.
Reflections from my Experience

- 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.
Recommended Training Intensity

- There is an abundance of scientific and anecdotal 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.
Recommended Training Intensity

- **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.
Long Term Athlete Development: Physical Competencies

- In addition to chronological age, the progression from levels 1 to 4 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.
Long Term Athlete Development: Physical Competencies

- 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 physical competencies 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.
Long Term Athlete Development: Physical Competencies

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.
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.
Training Supervision

- It is the position of the ASCA that all programs performed by children must be strictly coached by an adult(s) 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.
Model Programs for Level 1: 6-9 yr

- 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 with bands and broom sticks etc 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.
Model Programs for Level 1: 6-9 yr

- 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 and stretch (5 minute jog or cycle etc plus 2-3 minutes of light 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 brachia 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 brachia muscle).
  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 for Level 1

- **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.
Further progressions in Level 1

- Over time the athlete can increase the intensity of some of the exercises. For example, some options include:
  1. Increasing the step height for the step ups
  2. Push ups off toes rather than knees
  3. Progress from crunches to bent legged sit ups
  4. Chair dips performed with legs progressively further from the chair
  5. Hover off toes rather than off knees

- Over time, with continued adaptation, additional exercises may be added or substituted such as:
  1. Lying pull ups performed from under a small table or off a low bar (e.g., smith machine bar)
  2. Isolated DB exercises such as DB arm curls, triceps kickback, lateral raises
  3. Lunges
  4. DB Squats
  5. 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.
Final progression in Level 1

- Hence towards the end of the Level 1 period a typical program may involve the following exercises:
- Basic warm-up and stretch – 5 minutes
  1. Step Ups (both left and right legs) (quadriceps, hamstring and gluteal muscles)
  2. Push Ups (off toes) (pectorals, deltoid and triceps brachia 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 brachia 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.
Level 1 model programs

- There are many variations that could be done to the above programs.
- 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 and have them focus on performing controlled repetitions rather than rush to get to a particular repetition number.
- 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 room etc.
Model Level 2 Programs: 9-12 yr

- 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:
Model Level 2 Program

- Basic warm up and stretch (5 minute jog or cycle plus 2-3 minutes of light 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 sets, progressively building up to 3 repeated sets as the child advances and can readily tolerate the increased training volume.
Model Level 3 Program: 12-15 yr

- 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 accredited adult 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:
Level 3 model program

- Basic warm up and stretch (5 minute jog or cycle etc plus 2-3 minutes of light stretching)
  1. Front barbell squats
  2. Step ups holding light dumbbells
  3. Barbell bench press
  4. Chin ups – initially using a close underhand 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
  10. Barbell Arm Curls

- Cool down and stretch – 10 minutes
Level 3 model program

- 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 more complex and/or explosive exercises such as clean and press, squats, and deadlifts be included in the program and that competent instruction from a strength and conditioning coach with at least Level 2 accreditation be employed to instruct the athlete.
Level 4 Model Programs: 15-18 yr

- 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:
Level 4 Model Programs: 15-18 yr

- 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)
  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
Level 4 Programs

- Should change specific exercises throughout the week:
  - Mon and Fri perform Barbell Bench Press, Wed Inclined Bench Press
  - 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 exercise such as clean and press, squats, deadlifts etc and 1-2 minutes rest between sets for more basic exercises such as back extensions, sit ups etc.

- 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.
Level 4: Split routines

- 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.
Level 4: Model 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
  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.
Level 4: Model 2 way split routine

- *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.

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Level 4: Periodisation Strategies

- 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:

- 4 weeks of high volume and low intensity training performing 4 sets of 15-RM loads per exercise – followed by:

- 4 week of moderate volume and intensity training performing 4 sets of 10-RM loads per exercise – followed by:

- 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.
5. Injuries, how they are caused, appropriate lifting technique and injury prevention strategies

- One method to determine the prevalence, severity and types of injuries that occur when performing resistance training is from data available from the US National Electronic Injury Surveillance System (NEISS) which is a national probability sample of hospitals in the U.S. and its territories (see www.cpsc.gov/library/neiss.html).

- This web site allows an individual to enter an activity (eg such as Weight lifting, code 3265) for various age groups and determine:
  - The number of times individuals presented to hospital emergencies departments,
  - The outcomes from the presentation (e.g., admitted, treated and released, deceased etc), and
  - The reason for the accident (e.g., weight dropped on toe, hurt back while lifting etc).
Weight training injuries

- If age is limited from 6 to 17 years for the year 2006 and 3265 entered for the product code (i.e. Weight lifting) the system records some 531 presentations at emergencies departments in the sample which is estimated to represent 18,592 presentations across the US as a whole.

- Of these presentations about 98% were simply seen or treated and released not requiring hospital admission.
  - 33% of the injuries (6,093) were sustained at school,
  - 26% (4,796) occurred in the home,
  - 14% (2,624) occurred at a sport or recreational place.

- In examining the region of the body most likely to be injured the following were identified:
  - Finger 3,196 (17%)
  - Lower Trunk 1,930 (10%)
  - Foot 1,882 (10%)
  - Toe 1,386 (7%)
  - Shoulder 1,323 (7%)
  - Head 1,274 (7%)
US Hospital Presentation Data

- In examining the hospital presentation data for the 6-17 age group quite a few very basic types of reoccurring themes are clear eg dropped weight on foot, finger or toes, bumped head on bar or fell over lifting weights etc as well as strained back, shoulder or abdomen when lifting etc.

- In reading through the details of individual cases it reveals that in order to significantly reduce injuries to children in the weight room that more attention to basic safety issues such as putting weights and dumbbells safely away, using collars, basic training on loading and unloading bars, appropriate handling and storing of dumbbells, bars, plates and collars, strict supervision of children in weights area etc may well be of greater importance than instruction on lifting technique, especially for younger children (i.e. 6-13 year olds).

- The adherence to such basic safety issues should be particularly emphasized in the school and at home where most of these injuries occur.

- It should be understood that the weights areas is a very dangerous location for young children, full of heavy objects that are very hard when collided with and easy to fall over, bump into and drop on little fingers and toes.
Appropriate lifting technique

- As children progress through to the teenage years the number of lower back injuries from weight lifting tends to increase to a greater extent and appropriate instruction in lifting technique becomes increasingly important.

- In the Keynote Lecture for the International Society of Biomechanics entitled “The biomechanics of low back injury: implications on current practice in industry and the clinic”, Dr Stuart McGill (1997) presented a diagram of two different dead lifting techniques that clearly demonstrated that the optimal back posture while lifting is the normal lumbar curve that is present while standing erect.
The bionechanics of low back injury

Fig. 7. The fully flexed spine is associated with myoelectric silence in the back extensors and loaded posterior passive tissues, and high shearing forces on the lumbar spine. A more neutral posture recruits the shear-supporting pars lumbarum extensors, disables the shear imposing interspinous ligaments, and reduces the net shear on the spine.
Appropriate lifting technique

- McGill’s (1997) research clearly demonstrated that when adopting this natural lumbar curve when lifting the musculature of the lower back and abdominals are highly activated.
- This serves to take much of the load off the lower back ligaments and greatly reduces the net shearing forces on the spine.
- When this back position is not adopted and the lifter’s lower back flexes forward the musculature of the lower back and abdominals can not effectively function and this places much higher shearing forces on the ligaments and spine, increasing the likelihood of damage to these vital structures.
Injury Prevention: Training the Core

- The research of McGill (1997) clearly demonstrates that strong muscular action from the abdominals and lower back muscles can significantly serve to reduce dangerous shear forces on the spine.

- Hence training of the vital musculature of the abdominals and lower back should be a fundamental aspect to all training programs for children and youth through all phases of the training process.
Injury Prevention

- Resistance training can favorably enhance the strength of the musculo-skeletal system and has been shown to reduce the rate of sports-related injuries (Cahill and Griffin, 1978; Hejna et al., 1982; Hewett et al., 1999; Heidt et al., 2000).
- Each of these studies has shown that the performance of a preseason and/or in-season conditioning program that included resistance training significantly reduced the incidence of sports-related injuries.
- For example, in the study by Hewett et al. (1999) a 6-week conditioning program on high school female athletes decreased the incidence of serious knee injuries from 10 in the control (non-conditioning group) to only 2 serious knee injuries in the group who had performed the 6-week conditioning program.
Eliminating False Grips

- “During a 1-year period, 11 adult men died of asphyxia caused by barbell compression of the neck or chest as they performed heavy bench presses at home without a spotter (Lombardi, 1995), and a similar accident occurred in a 9-year-old boy (George, Stakiw & Wright, 1989).” (Faigenbaum, 2002 p 34).

- The bench press is arguably the most popular of all weight training exercises. One factor associated with serious injuries from the bench press exercise is the tendency for many experienced lifters to adopt a false grip, whereby the thumb is placed behind the bar rather than secured firmly around the bar.

- The use of a false grip is quite prevalent amongst experienced trainers and greatly increases the likelihood of the bar slipping out of the hands while bench pressing resulting in potentially devastating and even fatal injuries.

- A second factor is benching pressing without a competent spotter.
6. Legal cases involving weight training and children

- The Australian Legal Information Institute, which is a joint facility of the University of Technology Sydney and the University of New South Wales Faculties of Law (web site www.austlii.edu.au) contains legal cases.

- Cullen v Tathem (2000), which was heard in the Queensland District Court, order made 30 June 2000.

- Andrea Cullen injured her thumb in squat machine just prior to her 17th birthday and successfully sued the manager of the fitness centre, for $11,789 Ms Tathem, for failure to supervise or provide safety-warning signs.
Cullen v Tathem (2000)

- This case is interesting in that it clearly demonstrates that children cannot be expected to have common sense in a gym setting and that they require instruction and supervision.

- It is perhaps a little hard to believe that anyone would actually place one hand underneath a weight stack and then use the other hand to pull the pin out that holds the weight stack up not realizing that the weight stack was going to squash the hand placed underneath it. However, this is apparently what happened and the legal system then holds Ms Tathem, the proprietor of the Squash and Fitness Centre liable for this event. Ms Tathem had a duty of care to provide instruction for Miss Cullen or at the very least a warning sign that presumably would have stated something like “Don’t remove weight pins while lifting.”

- The requirement to provide clear instruction and adequate supervision for children in a weights room is an obvious implication from this case as is the understanding that children can do really silly things when in a gym and when they do these silly things the coach or owner may well be legally liable for them.
7. Nutrition & recovery strategies

“For the child athlete, energy intake should be high enough to support growth and maturation while providing enough energy and fluids for the additional physical activity.” (Cotugna, Vickery and McBee 2005 p 324).
ASCA Macro-nutrient recommendations

- Approximately:
  - 55% Carbohydrate: 5 to 10 g/kg bwt/day depending on training intensity
  - 25% Protein: 1.4 to 1.8 g/kg bwt/day
  - 20% Fat: Majority from unsaturated fats eg nuts, avocados etc
Protein Supplementation

- There is this ‘anabolic window’ that during which, ingestion of small amounts (eg 40 g) of protein/essential amino acid maximises the training response to resistance exercise.

- Hence the use of protein supplements prior to, during and immediately after intense exercise is advocated by the ASCA.

- Such supplementation should be performed within the overall upper limit of 2 g of protein/kg bwt/day.

- For example a 60 kg athlete may consume 60 g of protein from daily food and supplement 40 g of protein around their training session.
Creatine Supplementation

- The ASCA acknowledges that there is considerably controversy surrounding the use of creatine by young athletes.
- However, based on available published findings it is the opinion of the ASCA that the sensible use of creatine (5 g/day) is a safe and effective strategy to be employed by healthy young athletes.
Recovery Strategies

Based on available research data and currently adopted practices in elite sport, it is the position of the ASCA that active cool-down and water immersion (cold water, contrast hot and cold, and pool recovery sessions) are useful recovery methods that should be adopted by adolescent athletes in serious training.
8. Overall summary of the ASCA recommendations

It is the position of the ASCA that:

1. 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.

2. Prior to the commencement of resistance training all children should receive comprehensive instruction on gymnasium safety including use of collars, placing weights away correctly, correct handling and storage of dumbbells, barbells, collars and weights, appropriate spotting procedures, no playing around in the weights room etc.

3. Throughout their training period youth should be instructed by competent strength and conditioning coaches who can ensure correct lower back lifting technique involving the adoption of the natural lumbar curve and effective use of the abdominal and lower back muscles when lifting.
Recommendations: ASCA Position Stand

4. Strong muscular action from the abdominals and lower back muscles can significantly serve to reduce dangerous shear forces on the spine. Hence training of the vital musculature of the abdominals and lower back should be a fundamental aspect to all training programs for children and youth through all phases of the training process.

5. Technical competence in the performance of resistance training exercises is the primary focus for children and youth prior to any progression in loading or training volume.

6. All individuals should adopt a standard grip whereby the thumbs are securely rapt around the bar during all lifts where the bar is lifted above the body such as bench press. The use of a false grip is strongly discouraged.

7. The youngest a child should commence resistance training is at 6 years of age provided they have the maturity to follow clear instructions and an appreciation of the dangers present when training.
Recommendations: ASCA Position Stand

8. When training children and youth the long term athletic development of the child needs to be of paramount concern and various logical progressions in the training cycle are required to be systematically imposed throughout the child’s development which are age related but also muscular function dependent. 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 single joint exercises with dumbbells 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.
9. 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 such as strength and hypertrophy.

10. Resistance training can be effectively used to reduce the likelihood of the occurrence of sporting injuries by the development of the musculo-skeletal system and through reducing muscular imbalances.
Recommendations: ASCA Position Stand

11. 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. To coach youth in level 3 and 4 in the more complex lifts a coaching accreditation of at least 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.

12. 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” test, from which 1 RM can be extrapolated with reasonable accuracy.
Recommendations: ASCA Position Stand

13. Children and youth require appropriate energy intake:
   - 7-10 yrs 70 kcal/kg/day
   - 11-14 yrs 47-55 kcal/kg/day
   - 15-18 yrs 40-45 kcal/kg/day

14. Macro-nutrient recommendations are:
   - Protein 1.4 – 1.8 g/kg/day or 15-25% total energy intake
   - Carbohydrate 5-7 g/kg/day increased to 7-10 g/kg/day if engaged in intensive training; or 50-55% total energy intake
   - Fat lower limit 15%, with upper limit of 30% total energy intake
Recommendations: ASCA Position Stand

15. Supplement timing represents a simple but effective strategy that enhances the muscular adaptations from resistance training. There is this ‘anabolic window’ prior to and following training that during which, ingestion of small amounts of protein/essential amino acid maximises the training response to resistance exercise. Such supplement strategies may benefit young athletes wishing to increase lean body mass and strength.

16. Recovery techniques including active cool-down and water immersion (cold water, contrast hot and cold, and pool recovery sessions) offer an effective recovery strategy and should be adopted by adolescent athletes in serious training.