Effective Training Methods for Improving Adolescent Sports Performance

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Literature Review

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Sports performance coaches have recognized that training programs must meet the physiological needs of the specific age group that they are training. The National Strength and Conditioning Association (NSCA) recognizes and supports the premise that many of the benefits associated with adult resistance training programs are attainable by children and adolescents who follow age-specific resistance training guidelines (Moraes, Fleck, Dias & Simao, 2013). Harries, Lubans and Callister (2012) stated that resistance training interventions can improve the muscular power and motor skill performance of adolescents and subsequently may improve sporting performance (Harries, et al., 2012). A sports performance coach should understand the importance of providing adolescent athletes with effective training plans and proper supervision.

It is accepted that adolescent athletes, when provided a safe and well-designed resistance training program, can improve strength, speed and power. Nevertheless, a sports performance coach must consider adolescents adherence and motivation when developing a training plan that increases adherence and avoids training plateaus. Moraes et al., (2013) specified that a daily non-linear periodization model with variations in volume and intensity occurring from one training session to the next may reduce the “monotony” of performing repetitive training sessions and result in greater adherence. Increasing adherence by providing a well-designed supervised plan is just one of the many variables that a sports performance coach needs to contemplate when designing an effective sports performance training program.

Romano et al., (2013) recognized that the interaction of loading variables should be carefully considered during the prescription of resistance training programs such as the type of exercise, load, number of repetitions, number of sets, type of muscular contraction, speed, rest interval between sets and exercises, and also exercise order. However, Johnson, Burns and Azevedo (2013) caution that due to the complexity of designing resistance-training programs,
changing one variable could potentially set an athletic team apart from others in performance. Thus, the sports performance coach should select training variables that reflect the demands of each specific sport to elicit the greatest sports related performance improvements. Choosing the correct training variables is a complex process and a sports performance coach must thoroughly consider all aspects of adolescent sports performance improvement.

This written review will investigate some of the major training variables incorporated into a successfully complex training program. Some of the major program design variables such as exercise selection, exercise sequence and periodization are examined for their effectiveness. Training methods including flexibility, balance, resistance, speed, agility and quickness and plyometric training are reviewed for their effectiveness at preventing injury and improving coordination, explosive power and strength in adolescents.

Problem Statement

The purpose of this review is to determine the most effective exercise training program variables for improving adolescent sports performance.

Literature Review

Exercise Sequence

It is accepted that changing one training variable could potentially translate into a win or a loss in competition. A sports performance coach must determine the most effective exercise sequence by anticipating the influence of exercise sequence on sports performance attributes to maximize improvements. Johnson et al. (2013) recognized that either circuit or traditional style exercise sequence will produce equal results regardless of the beginning level of strength when strength is desired. Johnson et al. (2013) and Romano et al. (2013) distinguished that multi-joint explosive exercises should be utilized early in the training session to safely elicit the greatest
gains when fatigue is minimal. Romano et al. (2013) also found that different exercise orders across sequences did not affect the number of repetitions completed to failure.

The use of multiple-joint exercises in a traditional manner at the beginning of the workout could produce the most improvement and reduce the risk of injury, since fatigue is minimal. However, Romano et al. (2013) recognized a difference between the recovery rates of adolescent athletes and adult athletes, suggesting that adolescent athletes require less recovery time between exercises and that muscular performances are maintained when different exercise sequences are performed. So, any order of subsequent exercises could be effective for safely inducing performance improvements, since adolescent athletes have reported minimal effect on perceived exertion levels during subsequent exercises.

Periodization

Periodization or phases of variation in the training load is an accepted practice for avoiding performance plateaus in the sports performance and fitness industry. There are a few different types of periodization models that can be implemented when designing a sports performance training program. Ramalingam and Yee (2013) and Moraes et al. (2013) agreed that linear and daily non-linear periodization models are both effective in developing muscular endurance in adolescent athletes. Additionally, Moraes et al. (2013) found that the use of daily non-linear periodization training schedules successfully increased maximal strength and flexibility gains in comparison to non-periodized multi-set models. Currently the use of daily non-linear periodization models may be the most effective type of periodization for increasing adherence and improving adolescent sports performance.
Injury Prevention

Flexibility Training

Flexibility is an important aspect of injury prevention and sports performance training. Mahrova, Hrasky, Zahalka and Pozarek (2014) stated that improved flexibility, after a special training program, could lead to an increase of range of motion and serve as a protection from muscle imbalance and lower limb injuries. Static, active and dynamic flexibility training are a few of the flexibility training variations that should be considered when designing a sports performance training program. Chatzopoulos, Galazoulas, Patikas and Christos (2014) concluded that static stretching may have a negative effect on balance, agility and movement times when compared to dynamic stretching.

Chatzopoulos et al. (2014) reported that dynamic stretching may elevate muscle temperature and stimulate the nervous system better than static stretching. Mahrova et al. (2014) determined that a stretching program including dynamic components at the beginning of training sessions seems to lead to a decrease in muscle shortening. Both Chatzopoulos et al. (2014) and Mahrova et al. (2014) established that dynamic stretching could decrease the possibilities of injury in adolescent athletes. So, dynamic stretching may be the most effective flexibility training method to implement prior to training or sports competition to reduce the risk of injury and improve sports performance.

Balance Training

Sannicandro, Cofano, Rosa and Piccino (2014) believe that balance training intensifies proprioception by stimulating proprioceptors to provide feedback for the maintenance of balance and the detection of body position. Awareness of body position is accepted as a means of non-contact injury prevention, especially in adolescents. Reiko, Reiko & Toru (2014) stated that
adolescent females do not demonstrate sufficient neuromuscular adaptations due to rapid skeletal growth in comparison to male adolescents. This decrease in neuromuscular control may increase the risk of non-contact sports related injury. However, according to Sannicandro et al. (2014) training on unstable surfaces enhances inter-muscular coordination between agonist and antagonist muscles, permitting improved control of joint position and reduced joint stiffness. This improved inter-muscular control, as a result of balance training, may decrease the risk of non-contact injury in adolescent athletes.

Resistance Training

Many medical communities have suggested that weight training is safe and effective for developing strength qualities such as strength, muscular endurance and power, as this may increase the forces which they can withstand and make them more resistant to soft tissue injury and accommodate the rapid gains during puberty (Ramalingam & Yee, 2013). Christou, Smilios, Sotiropoulos, Volakis, Pilianidis, & Tokmakidis (2006) reported that specific neural adaptations, such as increased motor unit recruitment and improved coordination of the involved muscle groups occurred after resistance training programs in children and adolescents. This increased motor unit recruitment and improved coordination could decrease the risk of sports related injuries. Ramalingman and Yee (2013) believe that because strength is a by-product of muscular endurance training at low intensities, muscular endurance training may lower the risk of injury. However, low training intensities do not increase maximal power that can be developed through the use of explosive multi-joint exercises and forced repetitions. Both explosive multi-joint exercises and forced repetitions are accepted training methods for increasing power, a main attribute for improving adolescent sports performance. Augustsson et al. (2011) identified that
the primary reason for resistance training is performance enhancement, although it has also been used to prevent sport injuries and is an important aspect of injury prevention and rehabilitation.

Explosive Power and Coordination

Speed, Agility and Quickness Training

According to Buchheit, Mendez-Villanueva, Quod, Quensel and Ahmaidi (2010) and Milanovic, Sporis, Trajkovic, James and Samija (2013) speed and agility training is likely an effective training tool for the improvement of agility, acceleration and repeated sprint ability. Buchheit et al. (2010) concluded that sprint interval training is almost certainly more effective than speed and agility training for the improvement of intermittent aerobic performance. Although intermittent aerobic performance improves, Milanovic et al. (2013) reported that there was no improvement in performance during linear movement tests. This suggests that speed, agility and quickness training has specific benefits related to turning movements only. However, speed and agility training is likely to improve coordination, agility and the ability to change direction while running at maximal speed, which in turn improves repeated shuttle sprint performance (Buchheit et al., 2010). Because of the sports attribute improvements speed, agility and quickness training should be consider an integral part of sports performance training programs.

Plyometric Training

Agility, speed and power are important aspects of almost every sport. One way to improve these attributes is plyometric training (Mulcahy & Crowther, 2013). Mulcahy and Crowther (2013) reported that plyometric training should be incorporated in a sports performance training program and that training programs supplemented with plyometric exercises appear to improve adolescent agility and power. Mulcahy and Crowther (2013) and
Alptekin, Kilic and Mavis (2013) determined that plyometric training has demonstrated the ability to improve lower body power, explosiveness, elastic power, increase vertical jump height, acceleration, change of direction ability and sprint ability. Current research suggests that plyometric training is effective for increasing sports related attributes in adolescent athletes and should be included in a supervised training program.

Resistance Training

Established scientific organizations recommend resistance training for young people to enhance muscular strength, prevent sport injuries, improve performance in sports and recreational activities, and affect health and lifestyle in a positive way (Christou et al., 2006). It is widely accepted that resistance training can improve muscular strength in adolescents. A sports performance coach must decipher the most appropriate resistance training variables to effectively improve the strength of their athletes. Dasteridis, Pilianidis, Mantzouranis, and Aggelousis (2012) recognized that both hypertrophy and neuromuscular training variables increase strength in adolescents. Ramalingman and Yee (2013) found similar results of increased strength using higher volume and lower intensities, however the greatest increases in strength were documented using low volume and high intensity. These findings stress the importance of training specificity based on the specific demands imposed by each individual sport.

Conclusions

The reviewed research stressed the principle of specificity, program periodization, individualization, and supervision as important aspects for improving adherence and sports performance in adolescent athletes. A daily undulating periodization schedule, that includes a multi-joint exercise as the first exercise in a sequence of exercises, is also important for safety and consistent improvement. According to Moraes et al. (2013) daily non-linear periodization
can be used in this age group successfully to increase maximal strength and flexibility gains. Johnson et al. (2013) and Romano et al. (2013) agreed that either circuit or traditional style of exercise sequence will produce equal results regardless of the beginning level of strength when strength is desired and that exercise sequences do not affect the number of repetitions completed to failure. However, Buchheit et al. (2010) indicated that in well-trained sport athletes, fitness traits might need to be developed independently. Consequently, a sports performance coach must choose an appropriate periodization schedule, select relevant exercise sequences and include various training modalities to improve specific sport attributes.

Reiko et al. (2014) suggested that injury prevention training should be initiated in young athletes. A comprehensive injury prevention training program should include dynamic stretching, balance training and resistance training to stimulate the neuromuscular system and improve kinesthetic awareness. Additionally, Mulcahy and Crowther (2013) propose that plyometric training could be associated with improvements in an athlete’s coordination and landing technique which may decrease the risk of certain types of injuries from occurring. Thus, resistance training and plyometric training may not only be effective for improving sports performance attributes, but could also be effective training methods for reducing adolescent non-contact sports injuries. Buchheit et al. (2010) explained that in addition to sport-specific technical and tactical skills, strength, explosive power, speed, cardiorespiratory fitness and repeated sprint ability have been shown to be important factors determining success in many team sports. Moraes et al., (2013) established that resistance training is a safe and effective method of conditioning for children and adolescents, when performed in a safe environment, with correct exercise technique and with proper supervision. Therefore, it is recommended that an effective sports training program include resistance training, speed, agility and quickness
training and plyometric training to improve explosive power, speed, strength, and reaction times, ultimately improving adolescent sports performance.
References


