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CRITICAL COMMENTARY: THE NSCA POSITION STATEMENT ON YOUTH RESISTANCE TRAINING

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Abstract

In an updated Position Statement on youth resistance training, the National Strength and Conditioning Association claimed that the Statement was based on a comprehensive analysis of the scientific evidence for resistance training in children. This Critical Commentary challenges that claim and reveals that their recommendations, especially the inclusion of the snatch and clean and jerk lifts, are without scientific foundation.

Key words: *strength training, weightlifting, plyometrics*

The National Strength and Conditioning Association (NSCA) has an updated Position Statement on youth resistance training [1]. When discussing this Position Statement it is important to recognize the implication of the authors' primary claim: "*The NSCA based this position statement paper on a comprehensive analysis of the pertinent scientific evidence regarding the anatomical, physiological, and psychosocial effects of youth resistance training. An expert panel of exercise scientists, physicians, and health/physical education teachers with clinical, practical, and research expertise regarding issues related to pediatric exercise science, sports medicine, and resistance training contributed to this statement. The NSCA Research Committee reviewed this report before the formal endorsement by the NSCA*" (p. S60). Based on this long-winded self-serving claim by the NSCA and the authors of that Position Statement (Faigenbaum and colleagues), readers would expect that all the claims and recommendations would be supported by peer-reviewed resistance training studies in children. This Critical Commentary shows that this inference is not valid.

Faigenbaum and colleagues noted that the words *children* and *preadolescents* refer to boys up to age 13 years and girls up to 11 years. The term *resistance training* refers to the progressive use of a wide range of resistance loads with a variety of training modalities, which are designed to enhance health, fitness and sports performance. The word *weightlifting* was defined as a competitive sport that involves performance of the snatch and clean & jerk lifts [1].

The following paragraphs are specific examples of claims in the NSCA Position Statement that are not supported by resistance training studies in children. Science places the burden of proof on Faigenbaum and colleagues.

Faigenbaum and colleagues [1] claimed that the ideal approach to a resistance training program is to change the volume and intensity throughout the year. The only reference they cited to support that claim is a review by Kraemer and Ratamess [2]. The review is simply a summary of the American College of Sports Medicine (ACSM) 2002 Position Stand on resistance training [3]. That Position Stand has been shown to be without any scientific foundation [4] and has been removed from the ACSM's website. It has been replaced with an updated Position Stand [5], which is not much different from its predecessor and also has been shown to be bereft of scientific support [6]. In addition, the review by Kraemer and Ratamess based its resistance training guidelines on the authors' unsubstantiated opinions and studies with adults—not children. Faigenbaum and colleagues noted in this Position Statement [1] that adult exercise guidelines and training philosophies should not be applied to children.

After defining different training variables such as the order of exercise, training volume and intensity, repetition duration, rest between sets and exercises, frequency, and variation, Faigenbaum and colleagues [1] noted that a detailed description of these resistance training variables is available elsewhere. They cited six references. One of those references is a review on *quadrennial training* (defined as different aims and objectives for each of the four years) in high school athletes [7]. High school age is beyond the age of

children designated by Faigenbaum and colleagues. The other five references are books [8-12]. The NSCA failed to cite any resistance training studies to support guidelines for children.

Faigenbaum and colleagues [1] noted that the concentric and eccentric phase of each exercise should be executed in a controlled manner at a moderate velocity. However, they did not define *controlled manner* or *moderate velocity*. They did not recommend any range of repetition duration or speed of movement for concentric or eccentric movements, or cite any resistance training studies. The only reference cited was the previously mentioned 2002 ACSM Position Stand [3] on resistance training—for adults. In addition, the authors claimed that the use of different training velocities within a resistance training program may provide the most effective training stimulus. They claimed moderate to heavy loads are required for strength gains and light to moderate loads performed at an *explosive velocity* to increase power. Faigenbaum and colleagues claimed that a power component of 1-3 sets of 3-6 repetitions at *maximal velocity* should be included in a program for novice and intermediate adolescent trainees. They did not cite any reference—for adults or children—to support those opinions. One might question if an *explosive lifting velocity* can be performed in a *controlled manner*, especially in novice child trainees as recommended by Faigenbaum and colleagues.

Faigenbaum and colleagues [1] claimed that a study by Hamill [13] reported that there were similar injuries for weight training and weightlifting, and both were markedly safer than many other sports and activities. Consequently, Faigenbaum and colleagues claimed that with proper supervision and coaching, weightlifting (snatch and clean & jerk lifts) could be included in resistance training for children. However, Hamill sent out a questionnaire to high school teachers and requested a retrospective report of sports related injuries in 13-16 year old high school students in the UK. This age range was beyond the age of children as defined by Faigenbaum and colleagues. Hamill noted that most teachers lacked specific medical information and failed to follow the scheme of the questionnaire in detail, but nevertheless he compiled all the reported data. He stated in his questionnaire that if a teacher could not distinguish between weightlifting and weight training, then they should strike out weightlifting and enter those injuries as weight training. If some of the injuries were actually caused during weightlifting and entered as weight training, the results would have been skewed toward weight training. In fact, the reported injuries were similar in both categories. The actual weight training injuries must have been relatively low to account for any weightlifting injuries entered in that category and still produce equal results.

Hamill [13] stated that the teachers had all passed a course from the British Amateur Weightlifters Association (BAWLA) in the UK and all the teachers had pupils who were competitive weightlifters. That statement questions the effectiveness of the BAWLA course, how these teachers may have had difficulty distinguishing weight training from weightlifting, their ability to teach correct, safe weight training exercises, and coach students who compete in the sport of weightlifting. From this rather questionable retrospective analysis, Hamill concluded that there appears to be no rational case for anxiety concerning the performance of the snatch and clean & jerk lifts in children. Somehow this study oozed through the cracks of the supposed rigors of peer review.

As weightlifting coaches, Faigenbaum and Polakowski [14] suggested that the snatch and clean & jerk should be included in a resistance training program for children. They cited the aforementioned study by Hamill [13] in an attempt to justify the safety of weightlifting in children. Faigenbaum and Polakowski did not cite any evidence to support a transfer of gains in strength and power from weightlifting to other sports or physical activities that are any greater than gains in strength and power from conventional resistance training in children or adults. Although there are those who believe that the skill and balance required for learning the snatch and clean & jerk lifts are transferred to other athletic performance, there is no evidence to suggest that this acquired skill and balance is useful in any other sport [15].

In contrast to the opinion of Faigenbaum and colleagues [1] regarding weightlifting, a Policy Statement from the American Academy of Pediatrics [16] stated: "*Explosive and rapid lifting of weights during routine strength training is not recommended, because body tissues may be stressed too abruptly*" (p. 837). Because of the limited research on prepubescent injury rates in weightlifting, the Academy does not support the inclusion of weightlifting or powerlifting in preadolescents or adolescents. In addition, they recommended that the 1RM not be used to prescribe resistance training or to determine strength gains.

Faigenbaum and colleagues [1] claimed the inclusion of weightlifting and plyometric exercises in a resistance training program is more likely to result in the greatest improvement in motor skill performance. They did not cite any reference to support their claim. In contrast to that claim, Behringer and colleagues [17] recently reported the effects of two types of resistance training programs on motor performance skills (jumping, running, and throwing) in 34 inclusive studies out of 152 located in their literature search. The average age of the participants was 13.2 years, which included at least 85 preadolescent boys and girls. Training was classified as plyometric (defined as the stretch short-

ening cycle where the eccentric muscle action was immediately followed by the concentric muscle action) or traditional resistance training (resistance training that did not include a stretch shortening cycle). The interventions ranged from 6-68 weeks with a mean training frequency of 2.6 sessions per week. The average traditional resistance training program consisted of 2-3 sets of 8-15 repetitions with 60-80% 1RM for 4-8 exercises. The average plyometrics program consisted of 3-5 sets of 8-12 repetitions on 3-7 plyometric exercises such as vertical jumps, long jumps, shuttle runs, sprints, medicine ball throws, etc.

Behringer and colleagues [17] reported a significant positive correlation between the percent 1RM and motor skill performance with traditional resistance training but did not report any data for strength gains. There was no significant correlation between the number of sets, repetitions, or training sessions per week and motor performance skills. Most importantly, there was no significant difference between the two training modalities (plyometrics or traditional resistance training) on motor performance skills. Although they reported greater effect sizes from studies that combined plyometric and traditional resistance training compared with either plyometric or traditional training alone, those differences did not reach statistical significance. Behringer and colleagues concluded: "*Although it seems reasonable to achieve higher gains in other performance skills by implementing exercises (e.g., plyometrics) that are specific to the test in contraction type, movement velocity and movement pattern skills, no such difference in ESs* [effect sizes] *could be derived from the present data. That is, plyometrics training programs and traditional training regimens revealed comparable results*" (p. 201).

Faigenbaum and colleagues [1] recommended beginning a resistance training program with one or two sets of 10-15 repetitions and progressing to include additional sets with heavier loads of 6-10RM in order to maximize gains in strength and power. They did not cite any references to support their opinion that performing more than one set of each exercise would produce superior strength gains in children. Nor did they cite any evidence that reported any significant difference in outcomes when comparing sets of 10-15 repetitions with sets of 6-10 repetitions. In contrast to their claim, a recent review showed that in 82 out of 90 resistance training studies, the difference in RM or percent 1RM (heavier versus lighter loads) and the different range of repetitions used during training did not result in any significant difference in strength gains [18].

Two of the resistance training studies [19-20] cited in that review [18] are of special interest because they involved preadolescents. Faigenbaum and colleagues [19] randomly assigned 44 boys and girls (~5-12 years of age) to perform one set of either 6-8 repetitions or one set of 13-15 repetitions on each of 11 child-size exercise machines two times a week for eight weeks. Similarly, Faigenbaum and colleagues [20] randomly assigned 43 boys and girls (~8-12 years of age) to perform one set of 6-10 repetitions or one set of 15-20 repetitions two times a week for eight weeks. There was no significant difference in strength gains between the training groups in either study. Curiously, even though the primary author of the NSCA's Position Statement [1] is the principle author of both these studies [19-20], the only reference to these studies in the Position Statement was to support the statements that children who are involved in a resistance training program attain greater levels of strength than from normal growth and maturation. More importantly, the results of these two studies are antithetical to the aforementioned recommendations by Faigenbaum and colleagues regarding different ranges of repetitions in the Position Statement.

The claim by Faigenbaum and colleagues [1] that adolescents should perform three sets of 6-8 repetitions on multiple joint exercises (e.g., squat & bench press) and two sets of 10-12 repetitions on single joint exercises (e.g., biceps curl) is without any scientific support. In fact, the only reference they cited to support the superiority of multiple sets was the previously mentioned—and retracted—2002 ACSM Position Stand [3]. More importantly, that Position Stand did not include any reference to resistance training in children. Recall that Faigenbaum and colleagues stated in this Position Statement [1] that adult exercise guidelines and training philosophies should not be applied to children.

Faigenbaum and colleagues [1] claimed that the rest time between sets and exercises is of primary importance to coaches, teachers, athletes and researchers. They cited only one review on inter-set rest intervals in adults [21]. There is very little evidence—and none in that review—to suggest that different inter-set rest intervals will result in any significant difference in chronic physiological outcomes such as strength gains in children or adults [22].

Faigenbaum and colleagues [1] stated that the program variables for progression in resistance training in children were outlined in their Table 2 (p. S72) and Table 3 (p. S73) for gains in strength and power, respectively. However, they failed to provide any evidence to support a significant difference in strength gains or improvements in power as a result of training with a different percent of the 1RM, the number of sets or repetitions, inter-set rest intervals, repetition duration, or frequency of training in children or adults.

The recommendations by Faigenbaum and colleagues [1] in both Table 2 and Table 3 to use different percents of the 1RM in novice, intermediate and

advanced trainees for optimal increases in strength and power are highly questionable. In order to exercise at a specific percent of the 1RM, the inference is that the 1RM must be assessed or predicted for each exercise. A recent review [23] has demonstrated that neither procedure is required for progressive resistance training and as previously noted, a Policy Statement from the American Academy of Pediatrics stated that the 1RM should not be used to prescribe resistance training or assess strength gains in children [16].

In a study by Faigenbaum and colleagues [24], they assessed the 1RM and the maximal number of repetitions at 50% and 75% 1RM on Heartline chest press and Nautilus leg press machines in boys and girls ages 8-12 years. The authors noted: "*The range of repetitions performed by the subjects in this study at selected percentages of the 1RM is noteworthy. At 50% 1RM the scores ranged from 16 to 200 and at 75% 1RM the scores ranged from 6 to 43*" (p. 112). Faigenbaum and colleagues concluded: "*The results of this study demonstrate that a given number of repetitions is not always associated with the same percentage of the 1RM for all exercises. Thus, prescribing strength training exercises for children within a repetition range as opposed to a percentage of 1RM is suggested*" (p. 112). The recommendations in the Position Statement [1] are contrary to the results and conclusions of this study [24] by the same principle author.

Preadolescence may be a good time to include a traditional resistance training program with other physical activities to increase a child's muscular strength, power and endurance. A closely supervised child should never be injured—either acutely or chronically—as a result of resistance training. During late adolescence if the child is interested in competing in the sport of weightlifting, football, hockey, track and field events, etc., it should be clearly explained to the child and the parents that these explosive sports all have inherent risks for injury. Many strength coaches mistakenly believe that by practicing the sport of weightlifting (explosively moving a barbell from the floor to an overhead position), the transfer of muscular strength, power and endurance to another sport such as football is greater than from conventional resistance training. This is an unsubstantiated—yet widely-held—belief.

This Critical Commentary has demonstrated that the NSCA's recommendations were not based on a comprehensive analysis of the pertinent scientific evidence. Science places the entire burden of proof on the NSCA. For example, they must cite resistance training studies in children to support their opinion that the inclusion of the snatch and clean & jerk lifts will result in outcomes that are superior to resistance training programs that do not include those lifts. Adults can freely choose to follow resistance training recommendations or opinions that remain primarily unsubstantiated in any demographic. However, the question is whether those unsupported recommendations should be imposed on children.

Declaration of interest

The authors report no conflicts of interest.

Refrences

1. Faigenbaum A, Kraemer WJ, Blimkie CJR, et al. Youth resistance training: updated position statement paper from the National Strength and Conditioning Association. *J Strength Cond Res* 2009; 23: S60-79.
2. Kraemer WJ, Ratamess N. Fundamentals of resistance training: progression and exercise prescription. *Med Sci Sports Exerc* 2004; 36: 674-88.
3. Kraemer WJ, Adams K, Cafarelli E, et al. Progression models in resistance training for healthy adults. *Med Sci Sports Exerc* 2002; 34: 364-80.
4. Carpinelli RN, Otto RM, Winett RA. A critical analysis of the ACSM position stand on resistance training: insufficient evidence to support recommended training protocols. *J Exerc Physiol* 2004; 7: 1-64.
5. Ratamess NA, Alvar BA, Evetoch [sic] TK, et al. Progression models in resistance training for healthy adults. *Med Sci Sports Exerc* 2009; 41: 687-708.
6. Carpinelli RN. Challenging the American College of Sports Medicine 2009 position stand on resistance training. *Med Sport* 2009; 13: 131-7.
7. Jeffreys I. Quadrennial planning for the high school athlete. *Strength Cond J* 2008; 30: 74-83.
8. Chu D, Faigenbaum A, Falkel J. Progressive plyometrics for kids. Monterey, CA: Healthy Learning, 2006.
9. Faigenbaum A, Westcott W. Youth strength training for health, fitness and sport. Champaign, IL: Human Kinetics, 2009.
10. Kraemer WJ, Fleck SJ. Strength training for young athletes. 2nd edition. Champaign, IL: Human Kinetics, 2007.
11. Mediate P, Faigenbaum A. Medicine ball for all kids. Monterey, CA: Healthy Learning, 2007.
12. Roberts S, Ciapponi T, Lytle R. Strength training for children and adolescents. Reston, VA: National Association for Sports and Physical Education, 2008.
13. Hamill BP. Relative safety of weightlifting and weight training. *J Strength Cond Res* 1994; 8: 53-7.
14. Faigenbaum AD, Polakowski C. Olympic-style weightlifting, kid style. *Strength Cond J* 1999; 21: 73-6.
15. Sale DG. Strength training in children. In: Perspectives in exercise science and sports medicine. Volume 2: youth, exercise and sport. Gisolfi CV, Lamb DR, ed. Indianapolis, IN: Benchmark Press Inc., 1989: 165-222.
16. Small EW, McCambridge TM, Benjamin HJ, et al. Policy statement. Strength training by children and adolescents. *Pediatrics* 2008; 121: 835-40.
17. Behringer M, vom Heede A, Matthews M, et al. Effects of strength training on motor performance skills in children and adolescents: a meta-analysis. *Pediatr Exerc Sci* 2011; 23: 186-206.
18. Jungblut S. The correct interpretation of the size principle and its practical application to resistance training. *Med Sport* 2009; 13: 203-9.
19. Faigenbaum A, Milliken L, Moulton L, et al. Early muscular fitness adaptations in children in response to two different resistance training regimens. *Pediatr Exerc Sci* 2005; 17: 237-48.
20. Faigenbaum A, Westcott WL, LaRosa Loud R, et al. The effects of different resistance training protocols on muscular strength and endurance development in children. *Pediatrics* 1999; 104: 1-7.
21. Willardson JM. A brief review: factors affecting the length of the rest interval between resistance exercise sets. *J Strength Cond Res* 2006; 20: 978-84.

22. Carpinelli RN. A critical analysis of the claims for inter-set rest intervals, endogenous hormonal responses, sequence of exercise, and pre-exhaustion exercise for optimal strength gains in resistance training. *Med Sport* 2010; 14: 130-60.
23. Carpinelli RN Assessment of one repetition maximum (1RM) and 1RM prediction equations: are they really necessary? *Med Sport* 2011; 15: 91-102.
24. Faigenbaum AD, Westcott WL, Long C, et al. Relationship between repetitions and selected percentages of the one repetition maximum in healthy children. *Pediatr Phys Ther* 1998; 10: 110-3.

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