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Special Considerations for Designing Wrestling-Specific Resistance-Training Programs

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summary

The sport of wrestling presents several challenges to the strength and conditioning professional, such as bodyweight restriction, concurrent strength and endurance training, specific injury patterns, and unique metabolic demands, which can be resolved by designing the resistance-training program to match these requirements. This article offers recommendations for the implementation of an effective resistance-training program for wrestling.

Resistance training can significantly enhance performance in most sports and at all levels of competition. Improved body composition by increased skeletal muscle mass and decreased fat content, along with enhanced maximal force and power production, can benefit every athlete. Furthermore, resistance training may reduce the incidence of injuries and contribute to faster recovery, minimizing the number of missed practice sessions and competitions. To be effective, the resistance-training program should follow general training principles such as specificity, progressive overload, and individualization (5). An effective program should also follow a general periodization model, starting with high-volume/low-resistance general exercises in the off-season and progressing toward low-volume/high-resistance sport-specific movements as the competitive season approaches (4). Moreover, the development of a successful program calls for the analysis of the requirements of the specific activity that the program targets (6, 12).

The sport of wrestling is divided into 2 styles at the international level, Greco-Roman and freestyle, with similar physical requirements for the athletes. The design of strength and conditioning programs for this sport, with a few exceptions, is therefore independent of the competition style. The major difference between the disciplines is that the use of legs is permitted in freestyle wrestling both as a target and as a means of attack, whereas in Greco-Roman wrestling the contest is restricted to the body above the waist. The more familiar high school and collegiate wrestling in the United States resembles the freestyle with some differences in the rules.

Unique Demands of Wrestling

The sport of wrestling presents several unique challenges to the strength and conditioning professional. Above all, the weight-class system of the sport imposes restrictions, which have implications for both resistance training and conditioning. The resistance-training design should also address injury prevention through the selection of exercises that target common injury sites. These concerns, along with the metabolic and biomechanical demands of the sport, should be dealt with when conducting the sport-specific needs analysis before the design of the program (6). The nature of the activity, 3-minute periods interspersed with short bursts of maximal-intensity activity, requires high levels of strength and power along with excellent anaerobic capacity. Furthermore, the short rest interval (30 seconds between the periods at the international level and even shorter in high school and collegiate wrestling) and the possibility of overtime, which can extend a wrestling match up to 9 minutes, neces-

sitate the development of aerobic endurance. Accordingly, elite wrestlers have a high $\dot{V}O_2$max. For example, Utter et al. (15) reported a $\dot{V}O_2$max value of 56 $mL \cdot kg^{-1} \cdot min^{-1}$ for an elite freestyle wrestler in a descriptive study that is in agreement with the average values of the U.S. world team. The need for concurrent development of strength and aerobic endurance raises the issue of incompatibility of these training modes. This requires the use of careful periodization and prioritization of these fitness components in the various mesocycles.

Program Design for Wrestling

Along with weight-management issues and injury prevention, an effective sport-specific program for wrestling should consider the primary muscles used, contraction types, muscle actions, and the basic energy sources used in the activity (6, 12). The manipulation of acute program variables, such as exercise selection and order, exercise volume (sets × repetitions), exercise intensity, and length of rest intervals, is an effective means to target the specific needs of wrestling (6).

Bodyweight

Because of the previously mentioned weight-class restrictions in wrestling, excessive muscle hypertrophy may be undesirable in the sport. On the other hand, some athletes, especially in heavier weight categories, can benefit from improvements in body composition without altered bodyweight. In this case, increase in muscle mass along with fat loss should be the goal of the program. Moreover, the upper limit of the heavyweight category has been reduced from 130 kg (286 lb) to 120 kg (264 lb) after the 2000 Sydney Olympics; this challenges heavier wrestlers to effectively adapt to the new class while maintaining fat-free mass and maximal strength. A weight-class change caused by growth and maturation, which may occur in high school wrestling, requires the athlete to gain additional muscle tissue to be able to compete against larger wrestlers. The issue of weight management and body composition can be addressed by manipulating the volume and rest periods in resistance training and by performing high-volume/low-intensity aerobic conditioning supplemented with nutritional intervention. The nutritional aspect of weight management is beyond the scope of this article; thus, the strength and conditioning professional is advised to seek the help of a registered dietitian with this issue. In general, high-volume/short-to-moderate rest-interval programs are thought to contribute to muscle hypertrophy (1) and therefore can be either used or avoided depending on the goal of the particular athlete. Moreover, the categorization of athletes by weight demands high levels of strength relative to bodyweight. Therefore, wrestlers should strive to improve maximal force and power production while keeping the bodyweight constant or maintaining the weight class. Choosing bodyweight exercises, such as pull-ups, dips, and rope climbing, along with partner exercises (lifting or carrying a partner with similar bodyweight, which can be safely performed on the wrestling mat) can assist in the accomplishment of the goal of increasing relative strength. Moreover, weightlifting (Olympic style) lifts and their variations can be used to improve power output without the undue increase in bodyweight, because the time under tension during these lifts is minimal and the eccentric component is negligible.

Performance

The selection of exercises for a sport-specific program should match the recruitment patterns and muscle actions of the activity to maximize the transfer of training gains (6, 12). Strength and power capabilities are also vital components in wrestling. For these reasons, the weightlifting lifts are excellent choices for performance improvement in wrestling, because they require high levels of coordination and are very similar to the throws and several other moves executed in wrestling (11). Using variations of the Olympic lifts, such as overhead squat and drop squat, can also develop balance, dynamic flexibility, and proprioceptive awareness. Single-leg exercises can also be used to improve the ability to maintain and regain balance. Other excellent exercises, especially for Greco-Roman wrestling, are the deadlift and bent-over row, which mimic the lifts and throws from the parterre position on the mat. The performance of deadlift, without wrist straps, can also help develop adequate grip strength, which is necessary for the successful execution of holds and throws. Specific exercises that target the forearm, such as wrist curls and extensions, can also be performed for this reason. However, most forearm exercises should be performed in an isometric manner to match the contraction type typical for wrestling. Towel, rope work, and manually resisted movements are excellent choices (7), along with the previously mentioned bodyweight exercises, such as pull-ups and rope climbing (Table 1). Bodyweight exercises and weightlifting lifts can be included in the preseason and in-season periods to improve wrestling performance.

Injury Prevention

Exercise selection is also a key variable in injury prevention. The primary sites of wrestling injuries are on the upper body, particularly the shoulder, neck, and elbow, whereas knee injuries are the leading cause of lower-extremity problems (13). Therefore, the resistance-training program should aim to strengthen the surrounding structures to assist in joint stabilization and prevent damage to these areas. Exercises to develop the neck and shoulder muscles and surrounding areas, such as 4-way neck, shrug, and shoulder press, should be included in a wrestling-specific resistance-training program (Table 2). Wrestlers should focus on this area during the off-season preparation (anatomical adaptation) phase and may include injury-prevention exercises as assistant movements during the preseason and in-season periods.

Table 1
Exercise Selection for Performance Improvement

Snatch
Power clean
Push press
Overhead squat
Drop squat
Back squat
Lunge
Side lunge
Front squat
1-legged squat
Romanian deadlift
Deadlift
Bent-over row
Bench press
Incline press
Upright row
Wrist curl
Wrist extension
Dip
Pull-up

Table 2
Exercise Selection for Injury Prevention

4-way neck
Shoulder press
Front raise
Posterior deltoid
Shrug
Internal rotation
External rotation
Stretching (shoulder, neck, lower back, hamstring)

In addition to muscular strength, increasing range of motion around these joints may also help in injury prevention. Therefore, wrestlers should incorporate flexibility exercises in their training program in every mesocycle to achieve this goal. Shoulder, neck, and lower-back flexibility should be emphasized, because these areas are the most frequently injured body parts in wrestling. In general, these flexibility exercises can be performed at the end of every practice session for 20-second duration with 2 to 3 sets per exercise. For more specific recommendations on this topic, wrestling coaches and athletes should access the available literature.

Table 3
Core-Stability Exercises for Wrestling

Unilateral shoulder press with twist
Unilateral bent-over row with twist
Unilateral cable pull across the chest
Russian twist
Glut-ham raise
Good morning
Back hyperextension
Medicine-ball lateral bend
Medicine-ball giant circles
Medicine-ball lateral throw
Medicine-ball diagonal throw
Medicine-ball backward throw from squat
Medicine-ball underhand throw
Stability-ball exercises

Core Stability

Core stability is another important issue for both performance enhancement and injury prevention. In most sports, including wrestling, the core area or power zone (the gluteal muscles, the abdominals, and the lower back) is a crucial component of the kinetic chain, transferring forces from the lower extremities to the upper body. The strength of this section is mandatory for successful sport performance (9). Moreover, adequate strength of this area may also help prevent injuries by stabilization and protection of the spine and hip during movements executed with maximal or near-maximal force and power. The ability to exert and withstand rotational forces is a key aspect of wrestling success (11); thus, a resistance-training program should prepare the athlete for this component of the sport. Unilateral dumbbell exercises (8, 11), movements with medicine balls, cable exercises, and various abdominal twists, such as the Russian twist, are good choices for this area. Strength and conditioning professionals are also encouraged to consult books and videos that are available on the topic of stability-ball exercises and integrate these movements into a wrestling-specific program. See Table 3 for specific exercises. The off-season preparation and the preseason periods are good times to schedule core-stability training. Moreover, if additional work is necessary, core-stability exercises can be included in wrestling practice sessions during in-season cycles.

Training Mode

Wrestling relies heavily on the adenosine triphosphate phosphocreatine and lactic acid energy systems; therefore, an effective training program should address this specific metabolic demand (6, 11). Blood lactic acid concentrations can reach 19 $mmol \cdot L^{-1}$ in addition to significantly reduced pH during a wrestling match (6). Therefore, the ability to tolerate metabolic acidosis is imperative for successful wrestling performance. Although the primary mode of training to address this issue is anaerobic conditioning, resistance training can also contribute to the achievement of an optimal metabolic state. The ability to maintain force and power output under anaerobic conditions is trainable by manipulating the order of exercises in a training program. For example, by performing

Table 4
Combination Lifts for Wrestling

Complex 1 (3 repetitions of each)
Power clean
Push press
Front squat
Complex 2 (5 repetitions of each)
Bent-over row
Upright row
Overhead squat
Good morning

Table 5
General Periodization Model for Wrestling

Off-season (general preparation)	Aerobic endurance (low intensity/long duration) Resistance training (circuit training, injury prevention, core stability)
Off-season	Aerobic endurance (interval training, 1:1 work/rest ratio) Resistance training (injury prevention, core stability)
Preseason	Anaerobic capacity (interval training) Maximal-strength training
In-season	Power/power endurance Muscular endurance (combination lifts, circuit training, bodyweight exercises) Anaerobic capacity (interval training)

weightlifting lifts at the end of the program, the wrestler is challenged to exert high levels of power when already in a fatigued state. Similarly, scheduling plyometric exercises after resistance training in a single session can help develop power endurance along with longer-duration (30–60 seconds) plyometric exercises. Timed Olympic-style lifts can also be incorporated into a program, manipulating the time interval for the repetitions according to the needs of the athlete (11). A need to maintain force output during a wrestling match requires the development of muscular endurance. To meet this demand, circuit training has a role in a wrestling-specific program. Circuit training may increase capillarization, thereby increasing the potential to clear metabolic by-products, which, in turn, can allow the muscles to better deal with metabolic acidosis during exercise (14). The work-rest intervals should be adjusted with the progression of the training year to achieve the goals of the particular cycle. This training mode with shorter rest intervals can be used even in in-season mesocycles to develop the necessary muscular endurance for wrestling. Combination lifts are also excellent means to match the metabolic and functional needs of wrestling (10). According to Javorek (10), "Combination lifts consist of two or more free weight exercises that are combined in a nonstop, continuous movement" (p. 53). There are practically an infinite number of variations using this type of training (both barbell and dumbbell exercises may be used), and the number of repetitions for each exercise in the complex can be adjusted to meet the specific needs of the particular training cycle. See Table 4 for exercise recommendations.

The importance of isometric muscle action must be emphasized in a wrestling-specific program (8, 14). Besides the previously mentioned need for isometric grip strength, practically every wrestling move can have a static component, which may last for several seconds. For example, pulling and pushing moves may develop into static actions during a wrestling match when an equal resistive force opposes a wrestler's force. Isometric action may be even more important in heavier weight classes because of differences in wrestling technique and strategy compared with lighter weight classes. The duration of each isometric contraction should be manipulated based on the wrestler's need and on the particular training cycle. Isometric training can be undertaken with simple partner exercises and manual resistance along with the previously mentioned rope and towel work. Partner exercises are also desirable, because they develop competitive attitude and specifically prepare the wrestler for the actual activity with nearly complete carryover to the sport. Moreover, these exercises can be enjoyable for the athletes and can provide psychological recovery while developing important sport-specific traits.

Concurrent Training

Wrestling requires high levels of strength and power along with muscular endurance and the ability to tolerate metabolic acidosis (6). Maximal oxygen consumption should also be at an optimal level, because the short breaks in the action and the short rest interval between the periods in a match do not allow time for complete recovery. Moreover, the possibility of overtime also necessitates the development of aerobic endurance. The need for concurrent development of strength and aerobic endurance raises the issue of incompatibility of these training modes. It is well established that simultaneous training does not affect the improvement in aero-

bic endurance, whereas strength and power performances are adversely affected by high-intensity aerobic training (3, 14). The mechanism of this negative influence is not clear, although overtraining and differential adaptations are the most likely explanation. Strength and conditioning professionals should use careful periodization schemes and prioritization of these fitness components to minimize the negative effects of concurrent training. It is recommended that only 1 or 2 fitness components should be emphasized in a mesocycle, challenging the strength and conditioning professional to prioritize training in agreement with the yearly plan including the competition schedule (2). Table 5 offers general recommendations for periodization of these components. ♦

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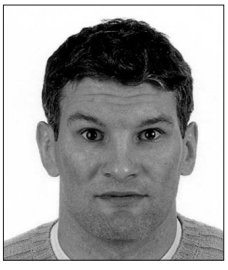

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