Exercise Technique



The Exercise Technique Column provides detailed explanations of proper exercise technique to optimize performance and safety.

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The Suspension Inverted Row

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A B S T R A C T

THE SUSPENSION-INVERTED ROW IS A MULTIJOINT UPPER-BODY **EXERCISE THAT CAN INCREASE** SHOULDER GIRDLE AND LUMBAR SPINE STABILITY, UPPER-BODY STRENGTH, AND PERFORMANCE OF ACTIVITES REQUIRING HIGH LEVELS OF STRENGTH. IT IS A VARIATION OF THE INVERTED ROW WITH A BAR AND IT CAN BE PRO-GRESSED, REGRESSED, AND PER-FORMED THROUGHOUT A TRAINING YEAR. THIS ARTICLE PROVIDES A DETAILED DESCRIP-TION AND FIGURES OF THE PROPER EXERCISE TECHNIQUE FOR A SUSPENSION-INVERTED ROW. FOR A VIDEO ABSTRACT OF THIS ARTICLE, SEE SUPPLEMENTAL DIGITAL CONTENT 1 (SEE VIDEO, http://links.lww.com/SCJ/A191).

INTRODUCTION

The suspension-inverted row is a variation of the traditional inverted row exercise that uses a bar set in a fixed position, which has been previously described (2,10,12). Like

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the traditional-inverted row. the suspension-inverted row is a closed kinetic chain, multijoint, upper-body exercise. Inverted rows have been used to improve shoulder girdle muscle activation and strength, muscle generated stiffness in the spine and athletic performance in sports like softball and hockey (3,6,9,10). They have also been used as a valid assessment of upper-body power (8). Suspension-inverted rows can provide comparable muscle activation with and in the case of the latissimus dorsi and posterior deltoid, greater muscle activation than the traditional-inverted row with a bar (12). This column provides detailed descriptions of proper exercise techniques, teaching cues, and modification strategies for performing the suspended-inverted row exercise.

BENEFITS OF THE EXERCISE

The suspension-inverted row uses body weight as the source of resistance or loading (for enhancing) (muscular strength, endurance, and performance (2,6–8,12,13). As will be discussed in a subsequent section, exercise intensity can be modified by changing body positions and angles in relation to the hanging point of the suspension system and by either placing the feet on the floor or elevating them on a training bench or box (7). Other methods to modify the suspension-inverted row will be described in the exercise variations section of this article. The suspension-inverted row imposes lower compressive and shear loads on the lumbar spine than rowing exercises like the bent-over row and one-arm cable row while providing comparable activation of upper back and posterior shoulder girdle musculature (3). Inverted rows have been used as a physical fitness testing tool with elite level athletes who engage in activities requiring high levels of upper-body strength (2,3,5,9,10).

The straps and handles of the suspension training system can be secured to a number of points, including the frame of a power rack, commercial suspension system frame, chain-link fence and with a special anchoring strap, the top of a closed door (3,9,13). As a result, the suspensioninverted row is more portable than the traditional-inverted row with a bar. It can provide an alternative mode of progressive resistance to free weight or machine exercises (6). The suspension-inverted row exercise can be a component of either a body weight only strength workout, mixed strength and endurance exercise circuit, or part of a workout using

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multiple exercise modes (including but not limited to free weights, dumbbells, machines, kettlebells, and tubing). The suspension-inverted row comprises 2 primary movement phases described and discussed further in the following exercise technique section.

EXERCISE TECHNIQUE

The suspension-inverted row comprises the ascending and descending phases. Performers grasp the handles of suspension straps attached to an overhead hanging point such as a power rack, commercial suspension system frame, chain-link fence, or door top in line with the lower chest with a slightly wider than shoulder width, pronated (palms away) hand grip while lying horizontally below the suspension straps. Elbows are fully extended, whereas the body is aligned in a straight line from the top of the head to the heels. The entire body (except for the heels) rests just above the ground at the bottom or starting position of the suspension-inverted row. Ankles are dorsiflexed and serve in conjunction with the heels as the fulcrum during the inverted row. The trunk maintains an upright, neutral position between flexion and extension with the head, shoulders, hips, knees, and ankles aligned (Figure 1) (2,5–8,12,13). During this starting position, isometric muscle actions facilitate trunk and shoulder girdle stability. The shoulder girdle is maintained in a relative position of abduction or protraction and the glenohumeral, elbow, wrist, and hand joints are maintained in positions of relative horizontal adduction and flexion, respectively (2,5–8,12,13).

During the ascending phase, the body is pulled upward toward the suspension strap handles in a controlled manner. While maintaining an elongated and neutral trunk position, the scapulae and glenohumeral joints are forcibly retracted or adducted and horizontally abducted, respectively. The elbow, wrist/hand are forcibly flexed (3,5,11,12). Table 1 provides a description of body segment motions, muscle activations, and actions occurring during the ascending and descending phases of the suspension-inverted row. The body is pulled upright in a curvilinear path until the lower chest is level with the handles of the suspension straps (3,5–8,11). Theoretically, the force and torque generating capabilities of the primary muscles involved in the suspension-inverted row are greatest in the first quarter of and progressively less during the last 3 quarters of the ascending phase of the exercise (4). The performer is encouraged to



Figure 1. Starting and ending position of the suspension-inverted row.

avoid all trunk and neck flexion and extension, swinging, kicking, and twisting motions, and to pause momentarily to allow the chest to rest against the bottom of the suspension strap handles. Table 2 provides teaching cues for addressing common performance errors occurring during the ascending phase of the suspended-inverted row. Maximal work and repetitions can be performed by maintaining a smooth and steady, controlled, and selfselected speed during the ascending phase of the suspension-inverted row (Figure 2) (2,3,7-13). A period of one to 2 seconds duration is appropriate during the ascending phase.

During the descending phase, the entire body is lowered to the original starting/static hanging position in a controlled manner while maintaining shoulder girdle, glenohumeral (shoulder) joint, and trunk fixation and stabilization (Figure 3). Clients should hold the entire body in a straight line when lowering themselves to the starting position (2,3,7-13). Eccentric actions of muscles discussed in the previous "ascending phase" section help the body to follow a curvilinear and controlled downward path and to prevent excessive scapular (shoulder girdle) elevation and abduction, glenohumeral (shoulder) horizontal adduction, flexion, elbow extension, and trunk flexion and/or extension. Table 2 provides a description of teaching cues for addressing common performance errors occurring during the descending phase of the suspended-inverted row. Clients having difficulty maintaining proper alignment and technique during either phase of the suspension-inverted row exercise might benefit from modifying the degree of difficulty of the exercise by changing both their body angle to the floor and horizontal distance from the overhead hanging point of the suspension straps (7). Both modifications will be discussed in the variations section.

VARIATIONS

Modifications in the intensity and degree of difficulty performing

Table 1 Muscle actions in the assending and descending phases of the suspension inverted rew								
Body segment	Ascending phase movements	Active muscles	Type of muscle action(s)	Descending phase movements	Active muscles	Type of muscle action(s)		
Shoulder girdle	Retraction as body is raised upward against gravity	Rhomboids, middle, and lower trapezius	Concentric	Controlled protraction as body is lowered with gravity	Rhomboids, middle, and lower trapezius	Eccentric		
Glenohumeral (shoulder joint)	Horizontal abduction	Infraspinatus, posterior deltoid, teres major, and latissimus dorsi	Concentric	Horizontal adduction	Infraspinatus, posterior deltoid, teres major, and latissimus dorsi	Eccentric		
Elbow	Flexion	Biceps brachii, brachialis, brachioradialis	Concentric	Extension	Biceps brachii, brachialis, brachioradialis	Eccentric		
Wrist/hand	Slight flexion	Flexor carpi radialis, flexor carpi ulnaris, palmaris longus, flexor digitorum profundus, flexor digitorum superficialis, and flexor policis longus	Concentric	Slight extension	Flexor carpi radialis, flexor carpi ulnaris, palmaris longus, flexor digitorum profundus, flexor digitorum superficialis, and flexor policis longus	Eccentric		
Lumbar spine	Maintains neutral position so that body is aligned in a straight line from the top of the head to the heels	External oblique, erector spinae	Isometric	Maintains neutral position so that body is aligned in a straight line from the top of the head to the heels	External oblique, erector spinae	lsometric		
Hip/pelvis	Maintains neutral position so that body is aligned in a straight line from the top of the head to the heels	Gluteus medius, gluteus maximus, and biceps femoris	Isometric	Maintains neutral position	Gluteus medius, gluteus maximus, and biceps femoris	Isometric		
References (3,5,7,11).								

Table 2 Teaching cues for the ascending and descending phases of the suspension-inverted row						
Observed movement error	Exercise phase	Teaching cue				
Failure to keep the ears, shoulders, trunk, hips, knees, and ankles aligned	Ascending and descending	"Keep a straight line from the head to the heels"				
Pulling the shoulders upward toward the ears	Ascending	"Avoid shrugging the shoulders"				
Rounding shoulders and protracting the scapula	Ascending	"Push the chest outward"				
Pulling predominantly with the arms at the elbow joint	Ascending	"Squeeze the shoulder blades together"				
Failure to complete the full range of movement during the upward pull of the body	Ascending	"Pull the arms and elbows down toward the floor and in toward the ribs."				
Allowing the trunk to flex and to hyperextend during the upward pull and at the end of the upward pull, respectively, or when lowering the body toward the starting position	Ascending and descending	"Stay tight" and "stay straight"				
Failure to achieve full elbow extension at the end of each repetition		"Come all the way down"				
Failure to lower the body in a controlled manner	Descending phase	"Avoid dropping" and "lower gently"				
References (2,3,6–13).						

suspension inverted rows can be accomplished by varying the length of the moment of inertia (length of the segment of the body being lifted and its distance from the anatomical fulcrum) (ankles/heels) (7). Melrose and Dawes found experimentally that the percentage of body weight lifted during the suspension-inverted row increases as the long axis of the body becomes less vertically and more horizontally oriented. They determined that their subjects lifted approximately 68% and 79% of their body weights when the long axis of their bodies were 60° and 75° from the vertical or upright standing position (30° above the horizon and 15° above the horizon), respectively (7). Suspension-inverted rows can be modified to make them progressively more difficult to perform by doing



Figure 2. End position of the ascending phase of the suspension-inverted row.

them in either a standing (Figure 4A and 4B), supine (Figure 2), or full horizontal position (with the long axis of the body parallel with the floor) with the heels elevated (across the end of either a standard portable training bench or plyometric training box (Figure 5A and 5B). As mentioned previously, the percentage of body weight lifted increases as the long axis of the body approaches a parallel with the ground position. Elevating the feet higher than the head further increases the intensity and degree of difficulty of performing suspensioninverted rows.

Suspension-inverted rows can also be performed by clients with less upperbody strength by keeping their knees flexed with their feet placed flat on the floor (Figure 6). This reduces the intensity of the exercise by decreasing the length of the moment of inertia or length of the body segment being lifted or moved (7). Exercise intensity and degree of difficulty performing specific variations of this exercise will dictate the number of repetitions that can be performed properly during a set and during a workout. Suspension-inverted rows



Figure 3. Descending phase of the suspension-inverted row.

can be performed with either a pronated, neutral, or supinated hand grip (Figures 7, 8, 9). Snarr et al. analyzed the effects of pronated versus supinated handgrips on muscle activation in the latissimus (dorsi, posterior deltoid, middle trapezius, and biceps brachii in subjects performing inverted rows with suspension straps and fixed bars. They found that suspension rows with a pronated hand grip produced the highest latissimus dorsi and posterior deltoid activation, whereas the supinated grip produced the greatest biceps brachii activation. Middle trapezius activation levels were similar between standard and suspensioninverted rows performed with a pronated hand grip. Mid-trapezius and posterior deltoid muscle activation was least when a supinated grip was used with both types of inverted rows (12). Although no electromyographic studies exist on the effects of a midprone or neutral forearm position, they present a viable performance option.

PRACTICAL APPLICATIONS

Client training status, current strength levels, and exercise program goals will dictate the exercise intensity, number of repetitions, and the variation of the suspension-inverted row to be performed during workout sessions (1).

More highly trained clients might vary the intensity and number of repetitions they perform during a training week and or within specific workouts (1). In this case, exercise variations, which include the employment of a horizontal body position, feet elevated on a bench or box (Figures 1, 2, 5A and 5B), and a weighted vest



Figure 4. (A) Start of suspension-inverted row from the standing position. (B) End position of suspension-inverted row from the standing position.

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Figure 5. (A) Start of the suspension-inverted row from a horizontal-elevated and heels-elevated position. (B) End point of the suspension-inverted row from a horizontal-elevated and heels-elevated position.



Figure 6. The suspension-inverted row from a horizontal- and knees-bent position.



Figure 7. The suspension-inverted row with a pronated grip.

(not shown) can be appropriate choices. Clients with less training experience and strength can select a variation of the suspensioninverted row that enables them to complete, with proper technique and control, a maximum of 8-12 repetitions to improve their strength (1). Initially, exercise variations, which include the employment of the standing and horizontal/supine with flexed-knee positions (Figures 4A and 4B, 6) might be most appropriate. In addition, performers can lean back so that their body is more horizontally oriented from the vertical standing position as they get stronger (7). An 8-15 repetition range has been used experimentally to successfully increase shoulder girdle muscle strength and function and athletic performance in subjects performing traditional inverted rows with a bar (6,9). Clients can select easier exercise variations enabling them to perform more repetitions during moderate or light-intensity training sessions and more challenging variations enabling them to perform fewer repetitions during higher-intensity training sessions. Proper exercise technique and control should supersede repetition number with all clients. Untrained clients can increase their strength by performing single sets of suspensioninverted rows on 2-3 nonconsecutive days per week, whereas more highly trained clients can experience greater strength gains by performing multiple sets (1).

The suspension-inverted row can be performed as part of an entire body weight exercise circuit, mixed strength, and aerobic endurance training circuit, or as part of a strength workout using free weights, machines, and other resistance-training modes (including but not limited to dumbbells, kettlebells, cables, and resistance tubing). The suspensioninverted row is an exercise that can be easily modified to improve upper-body strength, and physical performance in clients with varying levels of training experience, strength, and physical fitness.

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Figure 8. The suspension-inverted row with a neutral handgrip.



Figure 9. The suspension-inverted row with a supinated handgrip.

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