High-School PE Class Revisited

by Jason Karp, PhD on Feb 01, 2008

Ex Rx: Using vintage body-weight exercises never goes out of style.

Remember when you were in high school and your physical education (PE) teachers—intimidating in their gray, cotton sweats, wielding whistles—made you do push-ups, chin-ups and sit-ups? What about those long-forgotten Presidential Physical Fitness Tests, which required you to run different distances for time? Whatever happened to those “old-fashioned” exercises? While free weights and machines can certainly make your clients stronger, they often target muscles rather than movement. In addition, many free-weight and machine exercises, such as lat pull-downs and biceps curls, are open-chain exercises, which use only one joint as the resistance is moved away from or toward the body using freely movable limbs. In contrast, most body-weight exercises are closed-chain exercises, which use multiple joints as the resistance is moved away from or toward an anchored body part. Closed-chain exercises, which are more functional, result in greater motor unit activation and synchronization and better strength performance compared with open-chain exercises (Augustsson et al. 1998; Brindle et al. 2002; Stensdotter et al. 2003).

As they master their own weight, your clients will not only look better; they will also learn how to train three-dimensional movement, acquire a greater kinesthetic awareness and become empowered as they perform tasks with their bodies. Moreover, body-weight exercises make your clients’ workouts portable, an added benefit for people who travel a lot or for those who have trouble motivating themselves to go to the gym. Many of these “old-school” exercises are still used as tests of muscular strength and endurance (Dyrstad et al. 2006, 2007; Knapik et al. 2006).

Chin-Ups

From the time I first did chin-ups as part of the Presidential Physical Fitness Test in fifth grade, I was hooked. My fascination took me all the way to setting my junior-high-school chin-up record with 24 chin-ups. It doesn’t matter that it was years ago or that some tough kid has probably come along since to break my record. At the time, I had the strongest biceps and forearms in junior high. Your clients can also build strength in their biceps, forearms and upper back by doing chin-ups, as lifting their bodies a vertical distance of about 2 feet is no small task.

Push-Ups

If you’ve ever watched people in the gym do push-ups on their own, you’ve probably noticed that few people perform them correctly. That’s because most people cannot press their own body weight. While push-ups, which target the pectoralis major and triceps, may seem like a similar exercise to the more popular bench press, there are differences in how specific muscles are targeted. For example, Cogley et al. (2005) found that doing push-ups with a narrow hand position increases triceps and pectoralis major activity, while a wide grip increases pectoralis major activity during bench press. Lehman et al. (2006) found that triceps (but not pectoralis major) activity also increases during push-ups if the hands are on a stability ball instead of a bench.

Squats

The squat is among the most effective lower-body exercises, as it incorporates most of the leg muscles working through the kinetic chain. Contrary to popular belief, research has shown that leg position, stance width and squat depth do not affect quadriceps activity. Signorile et al. (1995) found that changing leg position by pointing the toes in, out or straight has no effect on quadriceps activity. McCaw and Melrose (1999) found that stance width does not affect quadriceps activity either but does influence adductor longus activity, with a wide stance (140% of shoulder width) eliciting greater muscle activity than a shoulder width or narrow stance (75% of shoulder width). Caterisano et al. (2002) found that there is no difference in vastus lateralis, vastus medialis, and biceps femoris muscle activity among partial, parallel and full squat depths.

Abdominal Crunches

With Americans on a never-ending quest for a flat stomach or six-pack abs, exercise equipment manufacturers have done everything they can to convince the public that buying their products will help to achieve that goal. But before your clients reach for the Ab Rocker sitting in the corner of the gym, remember that sometimes the old-fashioned way is the best way. There has been enough research comparing abdominal muscle activity from using commercial abdominal equipment versus doing traditional crunches to conclude that crunches are just as effective or better. Sternlicht et al. (2005) found that the Ab-ONE is the only commercial device that elicits a
higher rectus abdominis activity than a traditional crunch. They also found that crunches are better than the Ab Scissor, Ab Swing, 6-Second Abs and Torsor Track, and are equal to the Perfect Abs Roller. External obliques activity during crunches was higher than for the Perfect Abs Roller and was similar to the results for other equipment.

Despite people’s attempts to target the “upper” and “lower” abs, research does not support the concept that the upper and lower portions of the rectus abdominis can be preferentially recruited. Clark, Holt and Sinyard (2003) found no difference in upper and lower rectus abdominis activity between different exercises, with upper-body exercises (traditional crunch, crunch on stability ball and ab trainer-assisted crunch) eliciting greater muscle activity than lower-body exercises (reverse crunch, leg lowering from a supine position). Lehman and McGill (2001) also found no difference in upper and lower rectus abdominis activity between traditional crunches and straight-leg raises.

50-Yard Dash

A test of anaerobic power and sprint speed, the 50-yard dash reflects the ability of the phosphagen (ATP-CP) system to regenerate ATP for muscle contraction. To train your clients’ anaerobic power and 50-yard dash speed, have them run short, quick sprints lasting from 5 to 15 seconds at near-maximum speed with long rest periods (3–5 minutes) (e.g., 10 x 10 seconds all out, with 3-minute recovery periods). Workouts like these increase the recruitment and morphology of fast-twitch motor units and increase the muscle enzyme concentration of creatine kinase, which raises the rate at which muscle creatine phosphate is broken down. Short sprints have also been shown to increase glycolytic enzyme activity (Ross & Leveritt 2001), since the repetition of short sprints increases the glycolytic contribution to ATP regeneration.

600-Yard Run

A test of anaerobic capacity, the 600-yard run reflects the ability of anaerobic glycolysis to regenerate ATP and the ability of muscles to buffer the accompanying acidosis. To train your clients’ anaerobic capacity and 600-yard run speed, have them run 45-second to 2-minute intervals with a 1:2 work-to-rest ratio (e.g., 6 x 1 minute fast, with 2-minute recovery periods). Workouts like these increase muscle enzyme concentrations of glycogenolysis and glycolysis (Roberts, Billeter & Howald 1982), which increase the rates of the chemical reactions of those two metabolic pathways. These workouts also increase the muscles’ capacity to buffer acidosis (Ross & Leveritt 2001).

1.5-Mile Run

A test of aerobic power (V̇O_{2\text{max}}), the 1.5-mile run reflects the ability of the aerobic system to regenerate ATP. To train your clients’ aerobic power and 1.5-mile run speed, have them run 2- to 5-minute intervals at the speed that elicits V̇O_{2\text{max}} (near-maximum heart rate) with a 1:1 work-to-rest ratio (e.g., 5 x 3 minutes at near-maximum heart rate, with 3-minute recovery periods). Workouts like these increase mitochondrial volume, maximum stroke volume and maximum cardiac output, all of which together increase V̇O_{2\text{max}} (Billat 2001).

Overall Benefits

If you want your clients to get stronger, to improve their musculoskeletal function and their anaerobic and aerobic fitness, and to feel empowered by performing tasks with their own body weight, use these exercises from their high-school PE classes. And if they train hard enough, maybe they’ll even be able to break my chin-up record.

References


**SIDEBAR: Performing the Exercises Correctly**

While it’s an excellent idea to incorporate old high-school exercises into your clients’ workouts, the moves are not much use if they aren’t performed correctly. Use these notes as guidelines on body position and efficient, safe execution.

**Chin-Ups.** Grab a horizontal chin-up bar or the handles of a jungle gym with palms facing body and with hands shoulder width apart. From a hanging position with legs straight or knees bent, pull body up until chin reaches above bar. Lower body until arms are fully extended. To do pull-ups instead of chin-ups, grab bar with palms facing away from body. If your client cannot do chin-ups with his or her body weight, use a weight-assisted machine like the Gravitron, which uses a counterweight to reduce the amount of weight lifted.
Push-Ups. Kneel on floor with hands slightly less than shoulder width apart and palms on floor, legs lifted off floor, and back straight and parallel to floor. Clients who lack strength to do a standard push-up can modify this position by placing knees on floor, flexed to 90 degrees with ankles crossed. Keeping back parallel to floor, lower body down until chest touches floor. Push back up until arms are straight. Placing hands on a stability ball will also work abs.

Squat Jumps. In addition to traditional squats with body weight, your clients can add a plyometric component to acquire more powerful thighs. With hands on hips and feet shoulder width apart in squat position, jump straight up into air, extending hips, knees and ankles. Upon landing, lower into squat position in one smooth motion and immediately jump up again. Squat jumps can also be performed jumping off a box and should be done on a soft surface, such as grass, track or a gymnastics mat.

Crunches. In addition to traditional crunches, you can use variations with your clients, since many ab exercises elicit similar amounts of muscle activity. Willett and colleagues (2001) found that traditional crunches, twist crunches (twisting to one side while lifting torso), reverse crunches (raising legs and buttocks instead of torso) and V-sits (raising both torso and legs to create a V shape) all produce similar rectus abdominis activation. Vera-Garcia, Grenier and McGill (2000) and Clark, Holt and Sinyard (2003) found that the rectus abdominis and external obliques are more active when crunches are performed on a stability ball versus a stable surface.

SIDEBAR: PE Class-SStyle Training Program

Training is the same for the first 2 weeks of each 3-week cycle, with the third week used for recovery and adaptation. Have your clients do these workouts 2–3 times per week. As clients progress, initially increase volume (# of reps with body weight), then decrease volume and increase intensity (by adding additional weight) and recovery period.

Weeks 1 and 2

chins-ups: 2 x 10 reps with body weight (or weight-assisted machine), with 1-minute rest
squats: 2 x 10 reps, with 1-minute rest
push-ups: 2 x 8–10 reps, with 1-minute rest
Choose two exercises each workout from traditional crunches, V-sits, stability ball crunches, reverse crunches, twist crunches and medicine ball crunches: 2 x 20 reps for each, with 1-minute rest

Week 3 (Recovery)

Same as above, using 66% of # of reps from weeks 1 and 2 for each exercise.

Weeks 4 and 5

chins-ups: 2 x 15 reps with body weight (or weight-assisted machine), with 1-minute rest
squats: 2 x 15 reps, with 1-minute rest
push-ups: 2 x 12–15 reps, with 1-minute rest
Choose two exercises each workout from traditional crunches, V-sits, stability ball crunches, reverse crunches, twist crunches and medicine ball crunches: 2 x 30 reps for each, with 1-minute rest

Week 6 (Recovery)

Same as above, using 66% of # of reps from weeks 4 and 5 for each exercise.

Weeks 7 and 8

chins-ups: 2 x 10 reps with 105%–110% of body weight (or of weight lifted using weight-assisted machine), with 90-second rest
squats: 2 x 10 reps with 105%–110% of body weight, with 90-second rest
push-ups: 2 x 10 reps with 105%–110% of body weight, with 90-second rest
Choose two exercises each workout from traditional crunches, V-sits, stability ball crunches, reverse crunches, twist crunches and medicine ball crunches: 2 x 20 reps with 105%–110% of body weight for each, with 90-second rest

Week 9 (Recovery)

Same as above, using 66% of # of reps from weeks 7 and 8 for each exercise.

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