

Buff Up Your Muscular-Fitness Testing Skills

Steps for administering the most popular tests for muscular strength and endurance.

Many studies have shown that maintaining or increasing muscular strength and endurance throughout the lifespan is important for preventing disease, maintaining health and preserving the ability to perform normal life activities. Knowing how to measure a client's strength and endurance allows the personal fitness trainer (PFT) to establish baseline values in order to design an effective resistance training program and to measure the client's progression. Muscular-fitness testing should be considered a necessary tool in the PFT's evaluation toolbox.

TESTING MUSCULAR STRENGTH

Muscular strength is defined as the maximal force that can be generated by a specific muscle or muscle group during *a single movement* (ACSM 2005b; Heyward 2002; Howley & Franks 2003). The force generated is specific to the muscles involved, as well as the type (e.g., isometric or isotonic, concentric or eccentric), speed and joint angle of the contraction (ACSM 2005b). Strength testing results are usually expressed in terms of the amount of weight lifted during the test. The test that will be discussed in this section is the one-repetition maximum (1RM). Other strength tests include handgrip dynamometer (isometric) and isokinetic testing.

1RM Testing. The 1RM is the heaviest weight that can be lifted one time while maintaining good form. This type of maximal strength testing is considered the gold standard for evaluating dynamic strength (ACSM 2005b). Because this

type of testing involves the use of isotonic or dynamic muscular contractions, it translates well to real-life situations, as well as exercise performance.

Any exercise can be used to determine a 1RM. The procedures are as follows (ACSM 2005b; Heyward 2002; Howley & Franks 2003):

1. After a period of familiarization with the movement, have the client perform a light warm-up of 5–10 reps at 40%–60% of his or her perceived maximum resistance (light to moderate exertion).
2. After a 1-minute (min) rest with light stretching, cue the client to perform 3–5 reps at 60%–80% of perceived maximum resistance (moderate to heavy exertion).
3. Add 5–10 pounds (lb). If the client is successful at lifting that weight, allow a rest period of 3–5 min and add another 5–10 lb. Continue this process until a failed attempt occurs. Record the last successfully completed lift as the 1RM.
4. Express the results relative to the client's body weight (dividing the 1RM by the client's weight).

The goal is to find the 1RM within a maximum of five attempts. A good familiarization period and clear communication between you and the client are key to an accurate and timely result.

Is 1RM testing safe for everyone? Research has demonstrated that if appropriate procedures are followed, this test is safe for all ages and even for individuals with various clinical conditions, such as cardiovascular disease, diabetes, obesity and pulmonary disease (Heyward 2002). However, many professionals in the fitness or rehabilitation setting do not use the 1RM test to a great extent, preferring to be cautious with clients who have pre-existing conditions. With these clients, using one of the prediction equations, which employ a much lower resistance, is

a very helpful alternative. For a list of 1RM prediction equations, see Heyward 2002, page 128.

TESTING MUSCULAR ENDURANCE

Muscular endurance is the ability of a muscle group to execute *repeated contractions* over a period of time to fatigue. It can also be defined as the maintenance of a given amount of force for as long as possible until fatigue sets in, as in a bent-arm hang test. Whichever definition is used, the most important part of endurance testing is that no rest periods are allowed, especially between repetitions. The tests discussed in this section are partial curl-ups and push-ups. (Another alternative for upper-body muscular-endurance testing is the YMCA bench press test.)

Partial Curl-Up Test. The American College of Sports Medicine (ACSM 2005a) provides the following guidelines:

1. Have the client assume a supine position on a mat with the low back flat and the knees bent at a 90-degree angle. Arms are at the sides with palms facing down, and the middle finger of each hand is touching a piece of tape placed next to the body. A second piece of tape is placed 10 centimeters (about 4 inches) beyond the first piece.
2. Set a metronome to a count of 50 beats per minute. Cue the client to move through the range of motion, curling up to touch the second piece of tape and returning to the first piece in a slow, controlled manner to the beat of the metronome. (An alternative would be to omit the metronome, which would allow the client to move at his or her own pace. But using the metronome keeps the movement controlled, which may encourage correct form.) Remember, these are not full sit-ups,

- only partial curl-ups. The goal is to lift the shoulder blades so the trunk makes a 30-degree angle with the mat.
3. Direct the client to perform as many curl-ups as possible without pausing, up to a maximum of 25, for 1 minute.

Push-Up Test. The ACSM guidelines (ACSM 2005a) for the push-up test are as follows:

1. With male clients, utilize the standard “down” position, using the toes as the pivotal point. The hands are shoulder width apart, the back is straight, and the head is up. With female clients, use the modified “knee push-up” position, with hands shoulder width apart, back straight, legs together, lower legs in

contact with the mat, ankles plantar flexed and head up.

2. Have the client raise the body by straightening the arms and then return to the starting position, touching the chin to the mat. The stomach should not touch the mat at any time.
3. Instruct both men and women that the back must be straight at all times and the push-up must be to a straight-arm position.
4. Count the maximal number of push-ups performed in good form without rest. Stop the test when the client cannot maintain good form on two consecutive reps, or strains forcibly and cannot continue.

GETTING THE WHOLE PICTURE

A single muscular-fitness test does not give all the answers! These tests are specific to the muscle groups tested (e.g., push-ups for upper body, partial curl-ups for abdominals, etc.), and some tests are dependent on the speed of the muscular contraction or the joint angles (isometric testing modalities). The bottom line is, to get the most complete profile of a client’s muscular fitness, you should test both muscular strength and endurance and combine results from tests that evaluate different areas of the body. Charts for interpreting the results of these tests can be found in chapter 4 of ACSM’s *Guidelines for Exercise Testing and Prescription* (ACSM 2005a).

Jeffrey M. Janot, PhD, is an assistant professor of human performance in the department of kinesiology at the University of Wisconsin–Eau Claire. He is the technical editor of IDEA Fitness Journal. Contact him at janotjm@uwec.edu.

© 2005 by IDEA Health & Fitness Inc. All rights reserved. Reproduction without permission is strictly prohibited.

References

- American College of Sports Medicine (ACSM). 2005a. *ACSM’s Guidelines for Exercise Testing and Prescription* (7th ed.). Baltimore: Lippincott Williams & Wilkins.
- American College of Sports Medicine (ACSM). 2005b. *ACSM’s Health-Related Physical Fitness Assessment Manual* (1st ed.). Baltimore: Lippincott Williams & Wilkins.
- Heyward, V. 2002. *Advanced Fitness Assessment and Exercise Prescription* (4th ed.). Champaign, IL: Human Kinetics.
- Howley, E., & Franks, B. 2003. *Health Fitness Instructor’s Handbook* (4th ed.). Champaign, IL: Human Kinetics.

© 2005 by IDEA Health & Fitness Inc. All rights reserved. Reproduction without permission is strictly prohibited.

SOURCES OF ERROR DURING MUSCULAR-FITNESS TESTING

With muscular-fitness testing, as with any other type of fitness testing, errors can occur that will affect the outcome. Some errors can be attributed to the technician who administers the test, while others are due to the subject. Following are possible sources of error, with suggestions for minimizing them.

subject factors (them!)

PROBLEM	SOLUTION
Subject is inexperienced with equipment and movements.	Provide a familiarization period so subject can master the technique.
Subject lacks the motivation to use maximum effort.	Explain the importance of maximum effort for best results.
Subject is fatigued from multiple tests conducted in a short time.	Provide enough rest between tests, or test on consecutive days.
Subject fails to follow pretest guidelines.	Provide clear guidelines at least 2 days before testing.

technician factors (you!)

PROBLEM	SOLUTION
Technician lacks skill in administering test.	Practice technique with an experienced fitness professional.
Technician is unfamiliar with proper lifting and spotting techniques.	Practice with an experienced fitness professional.
Technician is unfamiliar with standardized testing procedures.	Review guidelines in a reference text.
Technician lacks proficiency in identifying improper performance.	Practice! Get experience with testing whenever possible.