

Maximal Upper-Body Strength

Equipment

- Bench press and appropriate free weights
- Physician's scale or equivalent electronic scale
- Stadiometer
- Calculator
- Stopwatch
- Individual data sheet
- Group data sheet
- Microsoft Excel or equivalent spreadsheet program

This laboratory activity is supported by a virtual lab experience in the web study guide.

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Warm-Up

Regardless of which method is used to assess muscular strength, each subject should perform a structured warm-up to prepare for the tests that will be performed. The warm-up should contain a 5 min general warm-up and a 5 min dynamic stretching warm-up (8). Sample general warm-up exercises include light jogging, cycling, and jumping rope. Dynamic stretching activities might include push-ups, arm circles and swings, and other activities targeting the upper body. After completing the warm-up protocol, the subject can begin the testing process.

1RM Bench Press Test

The bench press test requires a flat bench and free weights that provide for a range of possible loads. For example, various weight bars may be needed (e.g., 5 kg, 15 kg, 20 kg) depending on the population being tested. Ideally, you will have a barbell set with loads ranging from 0.5 kg to 25 kg to allow for a wide variety of loads. When performing the bench press test, it is essential to use appropriate spotting techniques (see figure 12.4). Briefly, the spotter should stand behind the bench press and use an **alternated grip** (i.e., one hand using a **supinated grip** and the other hand using a **pronated grip**) when lifting the bar out of the racked position on the bench and when helping rerack the barbell. It is also important for the subject to maintain five points of contact with the floor and bench—head, shoulders and upper back, right foot, left foot, and buttocks. Before starting the 1RM test, consult with the subject to estimate the subject's perceived maximum. This process can be challenging with untrained individuals because it is likely to be speculative at best. One possible method for estimating the 1RM is to estimate it off of the subject's body weight. This is typically done by multiplying the subject's body weight by a correction factor. For example, if a female subject weighs 60 kg and wants to estimate her 1RM for the free weight bench press, we would multiply this value by a correction factor of 0.35 to yield an estimated 1RM of 21 kg. With male subjects, the correction factor utilized for the free weight bench press is 0.60. Based upon this correction factor, the estimated 1RM for the free weight bench press for a 70 kg male would be 42 kg. When using this method, it is generally recommended that the maximum weight used is 79 kg (175 lb) for men and 64 kg (140 lb) for women. With athletes, in contrast, it is relatively easy to determine the perceived maximum because you can likely use



Figure 12.4 Bench press series: (a) liftoff, (b) starting position, (c) downward position, (d) upward movement, and (e) racking the bar.

the actual 1RM or estimates based on the individual's training weights. This value should be noted on the individual data sheet for laboratory activity 12.1 and used to calculate the 40% to 60% load, 60% to 80% load, and 90% load needed to conduct the test. Once the loads have been determined, use the following steps to conduct the assessment.

- Step 1:** Set up the bench press area with all the equipment needed to conduct the test.
- Step 2:** Gather basic data (e.g., age, height, weight) for the individual data sheet as described in laboratory activity 1.1. Have the subject put on his or her shoes.
- Step 3:** Lead the subject through a 10 min warm-up that includes dynamic warm-up activities such as arms swings to prepare the upper body for the bench press test.
- Step 4:** Load the bar with the weight corresponding to the subject's warm-up weight (40%-60% of perceived maximum). Move into an appropriate spotting position behind the bench press (figure 12.4a).

- Step 5:** Instruct the subject to lie on his or her back on the bench in a five-point-contact position (figure 12.4a). The subject's body should be positioned on the bench such that the racked bar is directly above the eyes. All repetitions should begin in this position.
- Step 6:** Upon the subject's command, lift the bar off the rack using an alternated grip. Guide the bar to a position over the subject's chest, and then release the bar to the subject (figure 12.4b).
- Step 7:** Have the subject lower the bar in a controlled manner to touch the chest at approximately nipple height while maintaining the five points of contact and inhaling (figure 12.4c). During this movement, keep your hands in the alternated position near the bar but not touching the bar.
- Step 8:** The subject should push the bar upward until the elbows are fully extended while maintaining the five points of contact and exhaling (figure 12.4d). At the end of the prescribed number of repetitions (5-10)—or if maximum is achieved—grasp the bar with an alternated grip and place it back on the rack (figure 12.4e).
- Step 9:** After the subject completes 5 to 10 repetitions with the 40% to 60% load, quickly change the load to the predetermined second-set load. The subject should have only 1 min to rest during this change.
- Step 10:** After the 1 min rest interval, conduct steps 5 through 8 and have the subject perform 3 to 5 repetitions with a load that is 60% to 80% of perceived maximum.
- Step 11:** After the completion of set 2, the subject rests for 3 min while you change the resistance to a load that is 90% of perceived maximum.
- Step 12:** After the 3 min rest, conduct steps 5 through 8 and have the subject perform 1 repetition with the 90% load.
- Step 13:** While the subject rests for 3 min, increase the load. If the attempt appeared relatively easy, increase the load by 5 to 10 kg. If, however, the attempt was more difficult, increase the load by 1 to 5 kg, depending on the weights available.
- Step 14:** Repeat steps 12 and 13, continuing to have the subject perform only 1 repetition until 1RM is achieved.
- Step 15:** If an attempt is unsuccessful, reduce the load by 1-10 kg, but keep it above the last successful attempt and have the subject rest for 3 min.
- Step 16:** After the 3 min rest, have the subject perform another attempt with the procedures outlined in steps 5 to 8.
- Step 17:** If the attempt is successful, increase the load by a small amount (1-5 kg) and repeat step 16. If the attempt is unsuccessful, the 1RM load is determined as the heaviest load successfully completed. Record the maximum weight lifted in the appropriate location on the individual and group data sheets.
- Step 18:** Divide the maximal weight lifted by the subject's body mass and record the result in the appropriate location on the individual and group data sheets. This value should then be compared with the data in the norm table for the bench press (see table 12.2). Based on the results, note the subject's strength classification and percent ranking on the individual data sheet.

LABORATORY ACTIVITY 12.1

INDIVIDUAL DATA SHEET

Name or ID number: _____ Date: _____

Tester: _____ Time: _____

Sex: M / F (circle one) Age: _____ y Height: _____ in. _____ m

Weight: _____ lb _____ kg Temperature: _____ °F _____ °C

Barometric pressure: _____ mmHg Relative humidity: _____ %

1RM Bench Press Test

Perceived maximum	Load	kg	Completed
Set 1	5-10 repetitions at 40%-60% of perceived maximum		☐
Set 2	3-5 repetitions at 60%-80% of perceived maximum		☐
Set 3	1 repetition at 90% of perceived maximum		☐
Set 4	1RM attempt		☐
Set 5	1RM attempt		☐

Note: 1 min rest between sets 1 and 2; 3 min rest preceding sets 3, 4, and 5.

Absolute 1RM = _____ kg

Relative 1RM = load (kg) / body weight (kg) = _____

Strength classification = % rank = _____

Notes:

Bench Press Predicted Maximum Test

Set	Load	Repetitions	Repetitions Completed	Completed
Warm-up set 1		6		☐
3 min rest				
Warm-up set 2		6		☐
3 min rest				
Warm-up set 3		6		☐
3 min rest				
Test set 1		To failure		☐
3 min rest				
Test set 2*		To failure		☐

*If test set 1 results in more than 10 repetitions, repeat the test after adding weight.

Bench Press 1RM Prediction Equations

Resistance (RepWt)		kg	<i>Note:</i> This resistance is 87% of 1RM.
Number of repetitions (RTF)			
1RM prediction	Adams (5)		
	Brown (11)		
	Mayhew et al. (34)		
	O'Conner et al. (39)		
	Reynolds et al. (40)		
	Tucker et al. (49)		