

TREADMILL EXERCISE TESTING

BRUCE SUBMAXIMAL TREADMILL EXERCISE TEST

THE BRUCE SUBMAXIMAL TREADMILL TEST IS PERHAPS THE MOST common test used to assess cardiorespiratory fitness, especially in clinical settings. The test is administered in three-minute stages until the client achieves 85% of his or her age-predicted maximum heart rate (MHR). In a clinical setting, the test is typically performed to maximal effort, to evaluate both fitness and cardiac function. **Given the degree of difficulty with this test, it is generally not appropriate for deconditioned individuals or the elderly.**

Equipment:

- Commercial treadmill
- Stopwatch
- Stethoscope and sphygmomanometer (with hand-held dial or with a stand)
- Ratings of perceived exertion (RPE) scale
- Heart rate (HR) monitor (optional)
- Medical tape

Pre-test procedure:

- Measure pre-exercise HR, sitting and standing, and record the values on a testing form or data sheet.
- Estimate the submaximal target exercise HR using the Tanaka, Monahan, and Seals (2001) formula for estimating MHR [(208 – (0.7 x Age) x 85%)]. Record this value on a testing form (this is one of the test endpoints).
- Discuss RPE and remind the client that he or she will be asked for perceived exertion levels throughout the test.
- Describe the purpose of the treadmill test.

Each of the stages is three minutes in length with a goal to achieve steady-state HR (HRss) at each workload. As long as HRss has been achieved, the speed and incline will increase at the end of each three-minute interval.

- Secure the blood pressure (BP) cuff on the client's arm (tape the cuff in place with medical tape to avoid slippage). Check the accuracy of the HR monitor if one is being used.
- Allow the client to walk on the treadmill to warm up and get used to the apparatus (≤ 1.7 mph). He or she should avoid holding the handrails. If the client is too unstable without holding onto the rails, consider using another testing modality. The results will not be accurate if the client must hold on to the handrails the entire time.

Test protocol and administration:

- This treadmill test begins at 1.7 mph and a 10% incline.

- Assess and record exercise HR and RPE at each minute; assess and record exercise BP at the 2:15 mark of each stage.
- The stages for the Bruce submaximal treadmill test progress are shown in the table below.
- Each stage is three minutes in duration. If the difference in the client's exercise HR between the second and third minute is >6 beats per minute (bpm), the HR has not achieved steady state. In this case, the client should continue for an additional minute at the same speed and incline.

- The test should be performed until signs or symptoms develop that warrant test termination or until the subject's HR response exceeds 85% of MHR. To ensure test validity and accuracy, the client's HR responses should exceed 115 bpm for at least two stages.
- Upon completion of the test, the client should cool down on the treadmill, walking at a moderate speed until breathing returns to normal and HR drops below 100 bpm. Three to five minutes should be sufficient.
- Calculate $\dot{V}O_2$ max and metabolic equivalent (MET) level using the following conversion formulas (Pollock et al., 1982; Foster et al., 1984).
 - ✓ Men: $\dot{V}O_2 \text{ max} = 14.8 - (1.379 \times \text{time}) + (0.451 \times \text{time}^2) - (0.012 \times \text{time}^3)$
 - ✓ Women: $\dot{V}O_2 \text{ max} = 4.38 (\text{time}) - 3.90$
 - ✓ To calculate METs, divide the $\dot{V}O_2 \text{ max}$ by 3.5 mL/kg/min
- Record values on the testing form.
- Continue to observe the client after the test, as negative symptoms can arise immediately post-exercise.
- Evaluate the client's performance/maximum oxygen uptake and classify using the normative data found in Table 8-12 of the *ACE Personal Trainer Manual* (5th Edition).

Contraindications

Treadmill exercise testing should not be conducted when working with a client with:

- Visual or balance problems, or who cannot walk on a treadmill without using the handrails
- Orthopedic problems that create pain with prolonged walking. Low-back pain (LBP) can be aggravated at inclines exceeding 3 to 5%. As obese individuals may suffer from both balance and orthopedic issues, treadmill testing may not be an appropriate modality for them. They may be better suited to a bicycle test if cardiorespiratory testing is considered appropriate.
- Foot neuropathy

BRUCE SUBMAXIMAL TREADMILL EXERCISE TEST PROTOCOL			
Stage	Speed (mph)	Grade (%)	$\dot{V}O_2$ (mL/kg/min)
1	1.7	10	13.4
2	2.5	12	21.4
3	3.4	14	31.5
4	4.2	16	41.9

Note: Each stage is 3 minutes in duration.