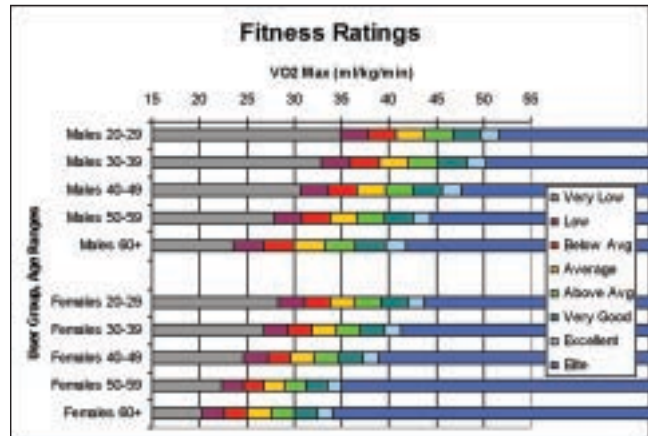


WHAT IS THE FIT TEST PROGRAM?

Fit Test is a user-administered fitness evaluation program that estimates a person's VO_2 max. The estimation is based on heart rate at a known exertion level and user statistics such as weight, age, and gender. VO_2 max represents a person's maximum aerobic capacity and the efficiency with which oxygen is exchanged with the active muscles. VO_2 max is expressed relative to body weight (ml/kg/min); therefore, notable improvements in VO_2 max can be tracked with regular exercise as a person's body weight decreases or as the efficiency of oxygen exchange increases, or as both improvements occur. This measurement is generally regarded by physicians and exercise physiologists as a very good measure of aerobic capacity.

Similar to fitness evaluation programs on treadmills and bikes, the Fit Test is a simple 5-minute test. Users can enter the program using the Personal Trainer button, and the console then prompts the user to enter a few simple statistics such as weight, age, and gender. Then the user is prompted to choose a resistance level and exercise for 5 minutes, during which they are prompted to maintain a constant speed. Toward the end of the 5 minutes, the program will look for a heart rate reading either via the Lifepulse hand sensors or via telemetry. Once a steady heart rate reading is acquired, the program calculates a VO_2 max estimate based on the user's weight, age, gender, resistance, speed, and steady-state heart rate.

The majority of users will find that their VO_2 max estimates fall within the range of 15-55 ml/kg/min. Generally speaking, men tend to have slightly higher numbers than women due to their larger heart size, lung capacity, and general mass. Furthermore, VO_2 max tends to decrease with age, even if a person stays fit and healthy. Because of these factors that can affect aerobic capacity, the program not only calculates a numeric VO_2 max estimate, but also relays a descriptive category rating. These ratings take gender and age into account, so don't be surprised when comparing numbers and ratings with your friends and workout buddies. People can have similar ratings but very different numbers, as well as similar numbers but very different ratings.



HOW WAS THE FIT TEST PROGRAM DEVELOPED?

The data for the Fit Test Program was collected in cooperation with Concordia University in River Forest, Illinois. The basis of the program is the collection of empirical submax VO_2 measurements and final VO_2 max measurement from a sampling of representative test subjects. 35 people were recruited to span the expected age, weight, gender, height, and athletic ability ranges of expected cross trainer users.

The subjects experienced a series of submaximal VO_2 test segments in which their heart rate and breathing increased until they reached a steady-state level at a known resistance and speed. Then the subjects were pushed to higher and higher exertion rates until their maximum aerobic capacity was reached. Subjects were fitted with breathing tubes connected to a metabolic cart in order to monitor their VO_2 and VCO_2 , breaths per minute, respiratory exchange ratio (RER), and heart rate. Throughout the survey, the test administrator [Professor Bill Duey, Concordia University] also recorded speed, resistance, and the user's rate of perceived exertion (RPE). VO_2 max was noted when the recorded VO_2 data showed a noticeable plateau or peak and the user's rate of perceived exertion topped out.

Once all of the data was collected, it was analyzed several ways in order to find the best prediction of VO_2 max for each subject given the known and measurable inputs. The theory behind this type of VO_2 max estimation is the Åstrand-Rhyming protocol, in which a submaximal heart rate at a known workload is used to predict maximal aerobic capacity. Various algorithms were tested for accuracy and program performance. The chosen algorithm predicts VO_2 max within 10% for the majority of exercisers. Users must note that even with the thorough test protocol and analysis methods, this prediction is an estimation and should not be used for clinical diagnosis. However, it is an excellent tool for self-assessment and periodic tracking.



SPEED DISPLAY

The speed displays on elliptical machines often have units of rotations per minute (rpm) or strides per minute (spm), which simply count how many times your feet travel a complete path in one minute, similar to a bike cadence. However, since the marketplace tends to use cross trainers as supplements or substitutes for running due to the weight-bearing and total-body nature of the exercise, it was desired to convert the speed display into units comparable to treadmill exercise. Therefore, the speed display is now in units of miles or kilometers per hour (mph/kph).

This conversion was done using a patent-pending algorithm which bases speed on ellipse geometry and rpm, as well as the biomechanics and physiological responses of walking and running. The distance, of course, follows as a calculation of speed and elapsed time and is displayed in units of miles or kilometers. Now exercisers can equate their cross trainer workouts to treadmill workouts or activities of daily living, using familiar units of speed and distance.

R E F E R E N C E S

Duey, William J., Ph.D., Commercial Cross Trainer Metabolic Expenditure / VO_2 Max Study, Concordia University, River Forest, Illinois, April 2003.

Life Fitness Biomechanics Engineering, Commercial Cross Trainer, Fit Test Program Research, November 2003.

Life Fitness Biomechanics Engineering, CT Speed/Distance Algorithm, July 2003.

Life Fitness Biomechanics Engineering, CT Distance Algorithm, March 2002.

ACSM's Guidelines for Exercise Testing and Prescription, Sixth Edition, 2000.

