Research Bites

by Michael R. Bracko, Ed.D., FACSM

NEW FORMULA FOR MAX HEART RATE

This important study investigated the relationship between age and maximum heart rate during exercise to develop a new and more accurate prediction equation (maximal heart rate formula), or to verify the most commonly used equation, for calculating maximum heart rate. Subjects included men and women aged between 20 and 78 years, all of whom exercised at a university-based fitness center between 1978 and 2003. Fitness records of 132 individuals who had multiple graded exercise tests (n = 908) for more than 25 years were analyzed. The exercise test was a modified Balke treadmill protocol performed to the limits of maximal performance.

The results of the study developed a new prediction equation (formula for calculating maximum heart rate): Heart Rate Maximum = 207 − 0.7 × age. The authors indicate that the formula of 220 − age originated in 1971 and was intended for an approximation of maximum heart rate. Many studies have shown that maximum heart rate declines at a rate of 3% to 5% per decade, independent of sex or fitness level. The formula of 220 − age suggests a decline of 5% to 7% per decade. Therefore, the formula of 220 − age may not be as accurate or as meaningful now as it was in 1971, whereas the formula of 207 − 0.7 × age closely matches and validates other research (1).

WHEN TO STRETCH? BEFORE OR AFTER A WORKOUT

In this timely research study, the investigators wanted to determine how flexibility would be affected by

stretching before or after a workout. The authors wanted to perform this research because controversy exists about the best time to stretch. Thirty college-aged men and women (n = 30) participated in the study. Treatment 1 consisted of walking on a treadmill for 5 minutes at 50% of age-predicted maximum heart rate, then performing three static stretches: quadriceps, hamstrings, and calf muscles. Treatment 2 consisted of 20 minutes of walking and jogging on a treadmill, followed by performing the 3 stretches. Intensity of walking/jogging for the second treatment was determined by daily activity level: sedentary, 60% of maximum heart rate; moderately active, 70% of maximum heart rate; and highly active, 80% of maximum heart rate. Both groups stretched each muscle group three times for 15 seconds in length. No measurement of stretching intensity was reported. The treatments were conducted 48 to 72 hours apart.

After each treatment group performed the three stretches, a goniometer was used to measure hamstring flexibility, ankle plantar flexion, and hip range of motion. The authors indicated that they were surprised to find that stretching after a workout did not improve flexibility more than stretching before a workout (actually, after a 5-minute walk). There were no significant differences between the treatments on any of the three flexibility measurements, although hip range of motion approached significance. These results contribute to the literature that indicates that there is no clear evidence to promote stretching before or after a workout (2).

FUNCTIONAL FITNESS FOR OLDER ADULTS

This is an interesting study because the authors compared aerobic, resistance, flexibility, balance, and Tai Chi exercise programs to investigate the effects of functional fitness on older Japanese adults. Functional fitness is important in older adults because improvements can enhance quality of life and the ability to perform activities of daily living and can prevent falls. Functional fitness was evaluated using the following assessments: chair stand, arm curl, up and go, sit and reach, back scratch, functional reach, and 12-minute walk. One hundred and thirteen older adults (age, 73 years; 64 men and 49 women) volunteered for one of the five above-mentioned exercise programs or were assigned to a control group.

The exercise programs were performed for 12 weeks. Resistance, balance, flexibility, and Tai Chi were performed 2 days per week, and the aerobic training program was performed 3 days per week. All exercise programs were 90 minutes in length. The training protocols were based on ACSM exercise recommendations.

Photo courtesy of Health Canada.

The results indicate that the only group who improved their cardiorespiratory fitness was the aerobic group (16%). The resistance group improved their upper-body strength the most (31%), and the balance group improved their lower-body strength more (40%) than other exercise programs. Improved balance/agility was the same for the resistance (10%), balance (10%), and Tai Chi (10%) groups. Functional reach improved the same for aerobic (13%), balance (13%), and resistance (13%). Interestingly, there were no improvements in flexibility. The authors conclude that an exercise program for older adults who want to improve their functional fitness could consist of two types of exercise: perhaps the most important is aerobic training and combining it with either resistance, balance, or Tai Chi training. These results are encouraging because it relates to getting older adults interested in exercise because they have more options for exercise (3).

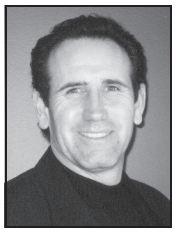
"JUNKYARD" TRAINING

Exercise professionals and strength and conditioning specialists are always finding alternative modes of exercise to keep their clients (and themselves) motivated. One alternative mode of training is called "junkyard training" that uses cement blocks, chains, anchors, and cars in nontraditional movement patterns. In this "nontraditional" study, the investigators measured the metabolic demands of pushing and pulling a 1,960-kg car 400 m in a maximal effort. Six male strength-trained subjects (aged 29 years) completed 3 testing sessions: pushing the car, pulling the car, and a treadmill $\dot{V}O_{2max}$ test. Oxygen consumption and heart rate were measured continuously. Blood lactate was measured before, and 5 minutes after, testing sessions 1 and 2. Vertical jump was tested before and after testing sessions 1 and 2.

The results indicate that there were no significant differences in $\dot{V}O_2$, heart rate, or blood lactate when pushing or pulling the car. $\dot{V}O_2$ and heart rate during the car push and pull tests averaged 65% and 96% of the treadmill test. Blood lactate during the car push and pull tests averaged 15.6 mm that was 131% of the treadmill test. Vertical jump decreased significantly pretest to posttest in both pushing and pulling the car (17%). The authors also indicate subjectively that all subjects were dizzy and nauseous during the car push and pull test. It was concluded from these results that pushing or pulling a car 400 m in a maximal effort requires very high anaerobic energy and must be considered an advanced form of training (4).

References

1. Gellish, R.L., B.R. Goslin, R.E. Olson, et al. Longitudinal modeling of the relationship between age and maximal heart rate. *Medicine & Science in Sports & Exercise®* 39(5):822–829, 2007.
2. Beedle, B.B., S.N. Leygid, and J.M. Carnucci. No difference in pre- and posterexercise stretching on flexibility. *Journal of Strength and Conditioning Research* 21(3):780–784, 2007.
3. Takeshima, N., N.L. Rogers, M.E. Rogers, et al. Functional fitness gain varies in older adults depending on exercise mode. *Medicine & Science in Sports & Exercise®* 39(11):2036–2043, 2007.
4. Berning, J.M, K.J. Adams, M. Climstein, et al. Metabolic demands of "junkyard" training: pushing and pulling a motor vehicle. *Journal of Strength and Conditioning Research* 21(3):853–856, 2007.



Michael R. Bracko, Ed.D., FACSM, is an exercise physiologist and director of the Institute for Hockey Research and the Occupational Performance Institute in Calgary, Canada. He is an associate editor for ACSM's Health & Fitness Journal® *and works in three areas: 1) sports physiology, where he conducts research on the performance characteristics of female ice hockey players, teaches high performance skating, and serves as physiologist for the University of Alberta Women's Hockey Team and the U.S. Men's Deaf Olympic Ice Hockey Team; 2) the health and fitness industry, by contributing to fitness magazines, consulting, presenting at health and fitness meetings such as the ACSM's Health & Fitness Summit & Exposition; and 3) as an occupational physiologist, in the areas of back injury prevention, ergonomics, workstation stretching, and prework warm-up.*