

**Focus on CME at McGill
University**

HEART DISEASE AND EXERCISE



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64

**By Ilka Lowensteyn, PhD,
Steven A. Grover, MD, MPA,
FRCPC,
and Dr. Mark Smilovitch, MD,
FRCPC**

DR. LOWENSTEYN is active staff, Centre for Cardiovascular Risk Assessment, Montreal General Hospital, Montreal, Quebec.

DR. GROVER is associate professor, McGill University, and director, Centre for Cardiovascular Risk Assessment, Montreal General Hospital, Montreal, Quebec.

Family physicians are in an ideal position to encourage increased physical activity in their patients. Not only does exercise reduce the risk of heart disease similar to other risk factor interventions but its minimal side effects make it particularly attractive as a general health promotion strategy.

Coronary heart disease is the leading cause of death and disability among Canadians. Epidemiologic research has shown that physical inactivity is directly related to an increased risk of developing coronary heart disease. A recent review of studies published on physical activity and heart disease found that inactive individuals are at twice the risk of developing heart disease than those who exercise three times per week for at least 20 minutes.¹ Accordingly, the increased coronary risk associated with

physical inactivity is similar to the increased risk associated with elevated cholesterol, elevated blood pressure or smoking a pack of cigarettes each day.² There are, however, substantially more inactive Canadians compared to the number who smoke, have high cholesterol or high blood pressure. Therefore, encouraging individuals to exercise may reduce Canadian heart disease rates more than treating any one of the other three modifiable risk factors. Similar American data have led the American Heart Association to declare physical inactivity a primary risk factor for heart disease.

The benefits of starting an exercise program appear to be greatest in the most sedentary individuals. The largest reduction in coronary risk occurs when an inactive individual adopts a modest fitness lifestyle.³ Greater levels of regular physical activity result in additional benefits, but the best response occurs when low levels of exercise are initiated by sedentary individuals (Figure 1). This suggests that even a modest improvement in fitness level among the most unfit will lead to substantial health benefits. In addition, the old adage of "no pain, no gain" is simply not true. It only takes a minimum of 20 minutes of moderate intensity aerobic exercise three times per week to receive major health benefits.³ Aerobic exercise includes any continuous, rhythmic, activity that uses large muscle groups, for example walking, swimming and cycling. Activities such as lifting heavy weights, yoga and stretching are not considered aerobic in nature.



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Dr. Ilka Lowensteyn

HOW DOES EXERCISE REDUCE CORONARY RISK?

There are a variety of mechanisms which may account for the protective

effects of physical activity in reducing the risk of heart disease. First, physical activity can positively affect other major coronary risk factors. Exercise has been found to be useful in increasing high density lipoprotein cholesterol (HDL-C), controlling mild and moderate hypertension, decreasing the risk of diabetes and reducing excess body weight.

HDL-C. Higher levels of HDL-C are associated with lower coronary risk. Recent studies have reported significant increases in HDL-C (between 5% and 15%) following aerobic exercise training. These positive changes seem to be directly related to both the intensity of exercise and the total weekly energy expenditure. The benefits predominantly occur in individuals who expend at least 1,000 calories per week performing moderate to vigorous exercise.[4](#)

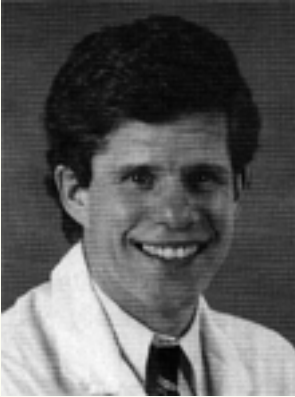
Blood pressure. High blood pressure increases coronary risk. Physical activity lowers blood pressure in individuals with mild and moderate hypertension. A recent review of 25 long-term studies concluded that aerobic exercise training leads to reductions in systolic and diastolic blood pressure, averaging 10.8 mmHg and 8.2 mmHg respectively.[5](#) These benefits are just as great, if not more so, with moderate intensity exercise as with high-intensity exercise.[6](#)

Diabetes is a major coronary risk factor. Regular physical activity can help manage and even prevent noninsulin-dependent diabetes mellitus. Beneficial effects from regular exercise include an increased sensitivity of cells to insulin, reduced glucose production by the liver, and an increase in muscle cells, which pound for pound use more glucose than fat cells.[7](#) In addition, a recent study of University of Pennsylvania male alumni suggests that exercise can decrease the risk of developing noninsulin-dependent diabetes mellitus.[8](#)

Weight reduction. Excess weight increases coronary risk. Regular exercise increases daily caloric expenditure. In one study comparing dieting and exercise in overweight sedentary men, both interventions resulted in modest weight loss.[9](#) In contrast to the dieting group, the exercise group did not have any loss of lean (i.e., muscle) weight. This preservation of lean body mass appears to be of significant benefit in patients attempting to lose weight since muscle tissue consumes calories, whereas fat tissue does not. The best approach to weight loss, therefore, appears to be a combination of moderate daily exercise (such as walking 4 km) and modest decreases in daily caloric intake (250 calories), which should lead to a weight loss of approximately one-half of a kilogram each week.

Other benefits. Risk factor modification accounts for less than one-half of the beneficial effects of physical activity. Regular aerobic exercise in and of itself is associated with lower coronary risk. The mechanisms remain uncertain but may include resistance to lethal cardiac arrhythmias and a reduced risk of coronary thrombosis, which may be due to a reduction in

platelet adhesiveness and the ability to aggregate, as well as increased fibrinolysis.[10](#) [11](#) [12](#)



The major health risks of exercise are small if the exercise program is initiated gradually and supervised properly. Overall, the benefits of exercise greatly outweigh the risks.

Dr. Steven Grover

RISKS OF EXERCISE

Although the exercise literature gives overwhelming support to the benefits of exercise, there are some risks involved. The major health risks of exercise training are muscle and joint injuries and sudden cardiac death. Cardiac deaths during exercise are highly publicized but they actually do not happen often. In one study of male joggers, it was found that there was only one death per year among 15,620 seemingly healthy individuals.[13](#) The rate of muscle and joint injuries among people who exercise on a recreational basis also is not very high. One study estimated that injuries requiring medical care occur at an annual rate of less than 5%.[14](#) The major health risks of exercise are small if the exercise program is initiated gradually and supervised properly. Overall, the benefits of exercise greatly outweigh the risks.

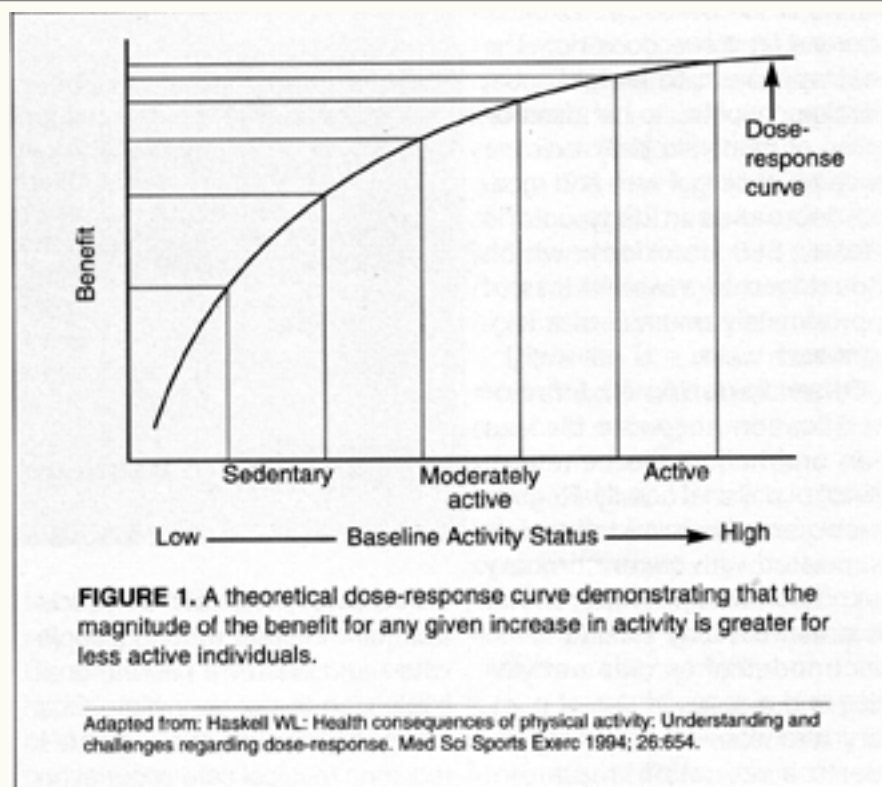
EXERCISE EVALUATION

For the typical inactive individual, there are a number of steps that should be followed to minimize the risks of exercise. The first step is a medical checkup. An exercise stress test may be necessary if the patient appears to be at increased coronary risk. Guidelines developed by the American College of Sports Medicine state that seemingly healthy individuals usually can begin moderate exercise programs (i.e., activities within the patient's current capacity that can be sustained comfortably for a prolonged period), without exercise testing, as long as the patient starts gradually and is alert to the development of unusual signs or symptoms

(Table 1).¹⁵ Men over the age of 40, and women over the age of 50, should have a maximal exercise test before beginning a vigorous exercise program (i.e., activities intense enough to represent a substantial challenge and result in significant increases in heart rate and respiration).

Individuals at any age who are at high coronary risk should have an exercise test prior to beginning a vigorous exercise program. High risk adults include those with two or more major coronary risk factors (i.e., hypertension, smoking, hypercholesterolemia, diabetes and family history) and/or symptoms suggestive of lung, heart or metabolic problems (i.e., chest discomfort, shortness of breath with mild exertion, leg cramps, tachycardia). For those without symptoms, an exercise stress test may not be necessary if moderate exercise is undertaken gradually with appropriate guidance.

Although many younger, healthy individuals do not need a maximal exercise stress test before embarking on an exercise program, it is useful if they undergo some form of fitness testing. A test such as the Canadian Standardized Test of Fitness evaluates the four main health-related areas of physical fitness (cardiorespiratory function, body composition, muscular strength and endurance, and flexibility). Results from a fitness test provide a picture of present health and fitness status and can be used to motivate patients. Strengths and weaknesses can be identified and periodic tests can verify if individual goals have been achieved.



The exercise program should be tailored to a patient's needs and should also be designed to promote long-term compliance. The initial exercise program should be enjoyable and it should not be painful or unduly stressful. The proposed program must also be realistic in terms of the patient's current fitness level, lifestyle and time commitment. Accordingly, a successful exercise program should be flexible, easily accessible and not too expensive. For example, it is not realistic to recommend swimming for someone who is a weak swimmer or has limited access to a pool.

Based on guidelines established by the American College of Sports Medicine, a basic cardiovascular fitness program should consist of a warm up, an aerobic conditioning period and a cool down.¹⁶ Individuals should wear loose-fitting clothing that provides protection from the sun, cold and wind; and proper footwear should be recommended, especially for diabetic patients.

The warm-up period should be five to 10 minutes in duration and should include low intensity exercises and a short stretching program. This leads to greater flexibility, prepares the cardiovascular system for more intensive work and decreases musculoskeletal injury.

The aerobic conditioning period usually lasts from 20 to 40 minutes. The most commonly recommended aerobic activities include brisk walking, jogging, swimming, bicycling, cross-country skiing, stepping and rowing (Table 2). Any type of aerobic activity that brings the heart rate into the target zone is acceptable. To estimate a patient's target heart rate, first determine the maximal heart rate (either directly from a maximal exercise test or calculated as 220 minus the patient's current age). Maximal heart rates should be multiplied by 65% and 85% to determine the lower and upper limits of a patient's target zone. For example, a 40-year-old patient would have an estimated maximal heart rate of 180 beats per minute (BPM) ($220 - 40$) and a target zone of 117 BPM to 153 BPM (180×0.65 and 180×0.85). For sedentary individuals starting an exercise program, the initial target zone can be modified by using 45% and 65% of their maximal heart rate as the lower and upper limits. Exercising at these lower limits may enable a greater number of patients to enjoy the health benefits by allowing them to incorporate many daily activities (including gardening, house cleaning and walking) into their activity program. A target heart rate zone should be determined before a patient begins an exercise program, and it should be used as a guide to make sure he or she are not exercising at too high or too low an intensity. The duration of exercise depends on the intensity of the activity. Therefore, lower intensity activities should be performed over a longer period of time.

Following the aerobic portion of the exercise program, a five to 10-minute cool down should be performed. Cool-down activities include walking or pedaling against very low resistance followed by a stretching period. This will prevent venous pooling, which may lead to hypotension, lightheadedness or syncope. The cool-down period may also decrease the risk of arrhythmias after aerobic exercise and may help prevent muscle soreness.

Exercise should be performed three to five times each week. The amount of improvement in aerobic capacity appears to plateau when the frequency is increased above five times each week. In addition, exercising more than five times per week may be too demanding for many individuals and may not allow the musculoskeletal system enough rest time to properly adapt, leading to a higher risk of sports injuries.

TABLE 1

GUIDELINES FOR EXERCISE TESTING AND PARTICIPATION

	Apparently healthy		Higher risk ^a	
	< 40 years in men	Older	No symptoms	Symptoms or disease (b)
	< 50 years in women			
Medical examination and diagnostic exercise test recommended prior to:				
Moderate exercise ^c	No	No	No	Yes
Vigorous exercise ^d	No	Yes	Yes	Yes

(a) Persons with coronary heart disease (CHD) or two or more risk factors for CHD (hyper-tension, hypercholesterolemia, smoking, diabetes, family history of CHD prior to age 55)

(b) Symptoms suggestive of CHD (chest pain or discomfort, shortness of breath upon mild exertion, dizziness, palpitations or tachycardia, claudication, etc.)

(c) A moderate exercise intensity is well within the individual's current capacity and can be comfortably sustained for a prolonged period of time

(d) A vigorous exercise intensity represents a substantial challenge and would ordinarily result in fatigue within 20 minutes

Adapted from American College of Sports Medicine. *Guidelines for Exercise Testing and Prescription*. 4th Ed. Lea and Febiger, Philadelphia, 1991.

TABLE 2

**ACTIVITIES NEEDED TO EXPEND
175 CALORIES IN A 68-KILOGRAM INDIVIDUAL**

To decrease the risk of heart disease, it is recommended that any of these activities be performed 3 to 5 times each week

Activity	Duration (minutes)*	Activity	Duration (minutes)
Weight lifting (light/moderate)	52	Shoveling (light)	26
General house cleaning	44	Skiing (downhill)	26
Cycling (leisure or < 10mph)	38	Soccer (casual)	22
Brisk walking (3.5 mph)	38	Stationary rowing (moderate)	22
Horseback riding	38	Cycling (moderate effort)	20
Calisthenics (light/moderate)	34	Singles tennis	20
House painting	34	Light/moderate swimming	20
Gardening	31	Basketball game	20

Softball or baseball	31	Stair climbing	20
Golf (carry clubs)	28	Cross-country skiing (moderate)	20
Push power mower	28	Ice hockey	20
Doubles tennis	28	Jogging/running (6 mph)	16

* For individuals weighing more than 68 kg, decrease the duration slightly. For individuals weighing less than 68 kg, increase the duration slightly.

Adapted from: Ainsworth BE, et al: Compendium of physical activities: classification of energy costs of human physical activities. Med Sci Sports Exerc 1993; 25:71 -80.

PROFESSIONAL EXERCISE GUIDANCE

Professional exercise guidance is highly recommended for both the exercise evaluation and the exercise prescription. Fitness appraisals are done by a variety of organizations including sports and recreation centers, YM/YWCAs and private fitness clubs. The exercise assessment and prescription should be performed by an exercise professional with either a college degree in exercise science (or a similar program) or certification by a reputable group. Acceptable certifications include the National Physical Fitness Appraisal Certification, Accreditation Program of the Canadian Association of Sports Sciences (CASS) and the Accreditation Program of the American College of Sports Medicine.

PROJECTED MAGNITUDE OF BENEFITS

What is the magnitude of benefit that an individual can expect from becoming physically active? A number of studies have calculated the increased life expectancy among active people versus their inactive counterparts. An American study estimated one year to two years of added life in the active group, whereas a Finnish study calculated 2.1 years of benefit.[17](#) [18](#)

The benefits of exercise are not limited solely to increasing longevity; exercise also can provide an improvement in quality of life. Active individuals are more likely than their inactive counterparts to claim that

CONCLUSION

Family physicians are in the ideal position to encourage increased physical activity in their patients. Not only does exercise reduce the risk of heart disease similar to other risk factor interventions but its minimal side effects make it particularly attractive as a general health promotion strategy. Given all the evidence suggesting the benefits of regular physical activity, exercise prescription should be considered a major component of any medical checkup.

SUGGESTED READING

1. ACSM position statement on the recommended quantity and quality of exercise for developing and maintaining fitness in healthy adults. *Med Sci Sports Exerc* 1990; 22:265-74.
2. Fletcher GF, Froelicher VF, Hartley LH, et al: Exercise standards: A statement for health professionals from the American Heart Association. *Circulation* 1990; 82:2286-2322.
3. Harris SS, Caspersen CJ, DeFriese GH, et al: Physical activity counseling for healthy adults as a primary preventive intervention in the clinical setting. *JAMA* 1989; 261 :3590-98.
4. Morris JN: Exercise in the prevention of coronary heart disease: Today's best buy in public health. *Med Sci Sports Exerc* 1994; 26:80700-14.
5. Powell KE, Blair SN: The public health burdens of sedentary living habits: Theoretical but realistic estimates. *Med Sci Sports Exerc* 1994;26:851-856.

REFERENCES

- 1 Powell KE, Thompson PD, Caspersen CJ, et al: Physical activity and the incidence of coronary heart disease. *Ann Rev Public Health* 1987; 8:253-87.

2 Pooling Project Research Group: Relationship of blood pressure, serum cholesterol, smoking habit, relative weight and ECG abnormalities to incidence of major coronary events: final report of the pooling project. *Journal of Chronic Diseases* 1978; 31:201 -306.

3 Blair SN, Kohl HW, Paffenbarger RS, et al: Physical fitness and all-cause mortality: a prospective study of healthy men and women. *JAMA* 1989; 262:2395-401.

4 Gordon N, Cooper K: Controlling cholesterol levels through exercise. *Compr Ther* 1988; 14:52-7.

5 Hagberg JM, Seals DR: Exercise training and hypertension. *Acta Med Scand* 1986; 711(suppl):131-6.

6 Gordon N, Scott C, Wilkinson W, et al: Exercise and mild hypertension: Recommendations for adults. *Sports Med* 1990; 1 10:390-404.

7 Hollander PA, Nordstrom J: Exercise and diabetes: Great for type 11, good for type 1. *Your Patient and Fitness* 1991; 5:6-13.

8 Helmrich SP, Ragland DR, Leung RW, et al: Physical activity and reduced occurrence of non-insulin-dependent diabetes mellitus. *N Engl J Med* 1991; 325:147-52.

9 Wood PD, Stefanick ML, Dreon DM, et al: Changes in plasma lipids and lipoproteins in overweight men during weight loss through dieting as compared to exercise. *N Engl J Med* 1988; 319:1 173-79.

10 Noakes T, Higginson L, Opie L: Physical training increases ventricular fibrillation thresholds of isolated rat hearts during normoxia, hypoxia and regional ischemia. *Circulation* 1983; 67:25-30.

11 Rauramaa R, Salonen J, Seppanen K, et al: Inhibition of platelet aggregability by moderate-intensity physical exercise: A randomized clinical trial in overweight men. *Circulation* 1986; 74:93944.

12 Eichner E: Coagulability and rheology: Haematologic benefits from exercise, fish, and aspirin: Implications for athletes and non athletes. *The Physician and Sportsmedicine* 1986; 14:102-10.

13 Thompson PD, Funk EJ, Carleton RA, et al: Incidence of death during

jogging in Rhode Island from 1975-1980. JAMA 1982; 247:2535-8.

14 Blair S., Kohl H, Goodyear N: Rates and risks for running and exercise injuries: Studies in three populations. Res Q Exerc Sport 1987, 58:221-8.

15 American College of Sports Medicine: *Guidelines for Exercise Testing and Prescription*. Lea and Febiger, Philadelphia, 1991, pp. 6-9.

16 American College of Sports Medicine position statement on the recommended quantity and quality of exercise for developing and maintaining fitness in healthy adults. Med Sci Sports Exerc 1990; 22:265-74.

17 Paffenbarger RS, Hyde R, Wing AL, et al: Physical activity, all-cause mortality and longevity of college alumni. N Engl J Med 1986, 340:652-5.

18 Pekkanen J., Marti B, Nissinen A, et al: Reduction of premature mortality by high physical activity: a 20-year follow-up of middle aged Finnish men. Lancet 1987; 125:601-10.

19 Paffenbarger RS, Kampert JB, Lee IM, et al: Changes in physical activity and other lifeway patterns influencing longevity. Med Sci Sports Exerc 1994; 26:857-65.