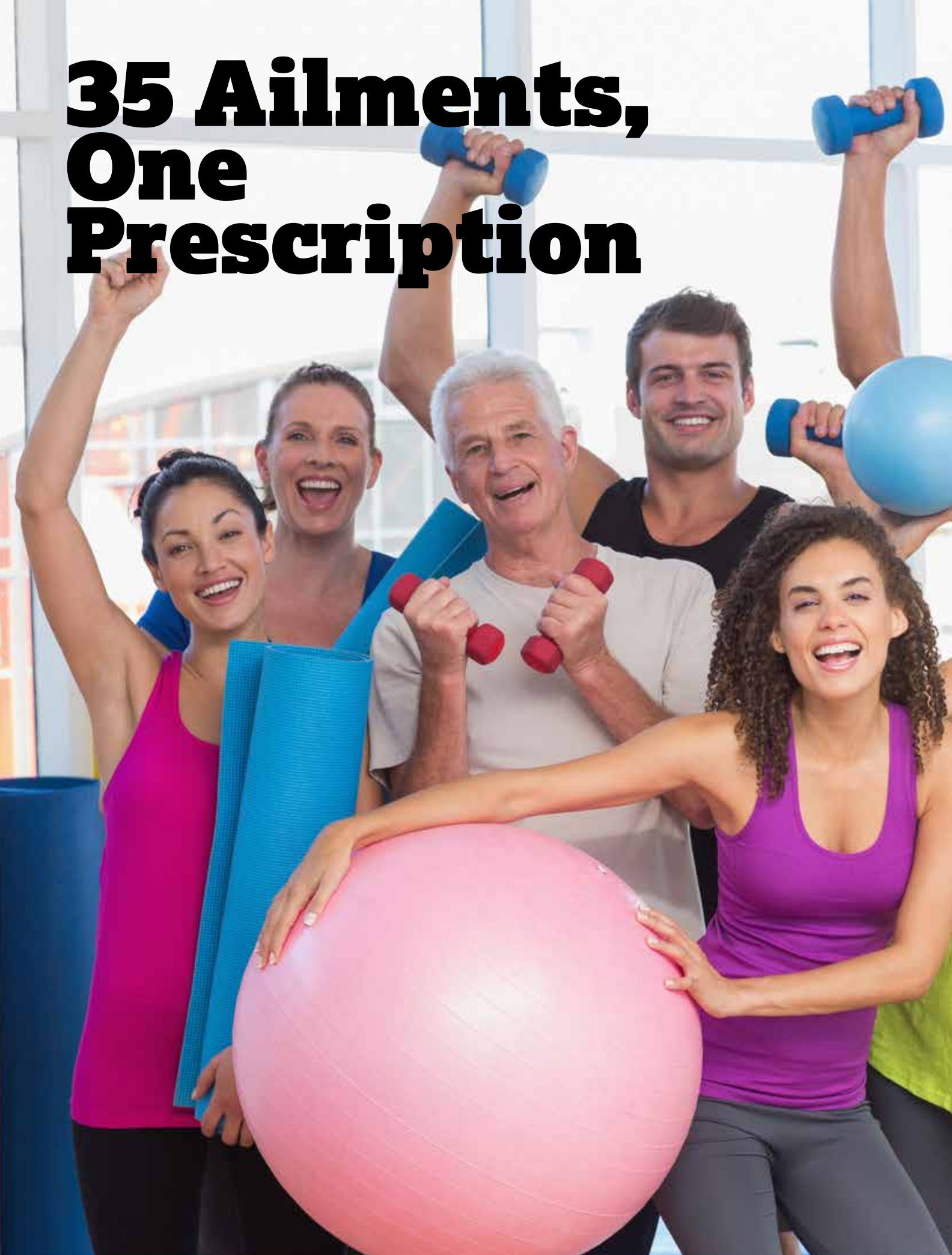


35 Ailments, One Prescription





Studies suggest that physical activity reduces the risks of nearly three dozen harmful conditions and life-threatening diseases.

**By Galen A. Morton, MA,
and Len Kravitz, PhD**

It's not exactly news that physical activity and exercise have powerful health benefits. Indeed, it's an insight almost as old as recorded history.

In the fifth century BC, the famous Greek physician Hippocrates observed, "All parts of the body, if used in moderation and exercised in labors to which each is accustomed, become thereby healthy and well developed and age slowly; but if they are unused and left idle, they become liable to disease, defective in growth and age quickly" (Kokkinos & Myers 2010).

Scientists have proved Hippocrates right time and again in recent years. In a review of the latest science, Booth, Roberts & Laye (2012) point to 35 chronic diseases and health conditions (see the sidebar "Combating 35 Health Problems") that regular exercise and physical activity do much to prevent. Booth and colleagues also indicate that 92% of adolescents and 95% of adults in the U.S. do not meet minimum guidelines for physical activ-

ity. This presents countless opportunities for personal trainers and other exercise professionals to make a difference in people's lives.

Franklin (2008) stresses that our ever-growing reliance on technology—including automobiles, elevators, remote controls and energy-saving devices—explains the prevailing lack of physical activity. Franklin also underscores that regular physical activity, not a drug or pill, is the best strategy to combat sedentary death syndrome (SeDS)—chronic, potentially life-threatening disease caused by an inactive lifestyle (see Figure 1; Figure 2 depicts the health benefits of regular resistance training).

This review dives into recent science on the major health benefits of exercise and physical activity, and divides the major findings into seven categories:

1. Low Cardiorespiratory Fitness ($VO_2\text{max}$)
2. Cardiovascular Diseases
3. Bone and Joint Diseases
4. Depression, Anxiety and Cognitive Dysfunction

5. Nonalcoholic Fatty Liver Disease, Accelerated Aging and Digestive Tract Diseases
6. Insulin Insensitivity and Diabetes, Metabolic Syndrome and Obesity
7. Cancer

1 Low Cardiorespiratory Fitness ($VO_2\text{max}$)

Low peak exercise capacity (or $VO_2\text{max}$) is a more powerful predictor of mortality than any other recognized risk factors for cardiovascular disease, say Myers et al. (2002). As expected, their study—which investigated 6,213 men—found a positive association between high $VO_2\text{max}$ and optimal health.

Men and women alike enjoy this protective effect of higher maximal exercise capacity, according to Roger et al. (1998); in a cohort of 741 women and 1,452 men, a low $VO_2\text{max}$ exhibited the strongest association with all causes of mortality and cardiac events.

Booth, Roberts & Laye (2012) assert that low cardiorespiratory fitness is a more sound predictor of death than risk factors such as hypertension, smoking, diabetes and exercise-test variables, including abnormal electrocardiographic indicators (e.g., ST segment depression), or the development of heart irregularities (e.g., arrhythmias) during exercise. And Kodama et al. (2009), in a meta-analysis of data from 33 studies with 102,980 men and women, state that each MET (3.5 ml O_2 /kg/min) increase in maximal aerobic capacity yields a 13%–15% decrease in risk of cardiovascular disease and all causes of mortality.

These studies demonstrate the decisive importance of cardiorespiratory training for improving health and reducing disease risk.

2 Cardiovascular Diseases

Cardiovascular disease (CVD), which encompasses various afflictions of the heart and blood vessels, accounts for at least 1 in 3 deaths in the U.S. (Mozaffarian et al. 2015). While physical inactivity worsens the health damage from CVD, Seals et al. (2009) note that regular aerobic exercise is associated with lower risk of CVD.

Middle-aged and older adults who are trained in endurance exercise have less large-artery stiffness and better blood vessel dilation than their sedentary counterparts (Seals et al. 2009). Exercise influences these common CVDs:

CORONARY HEART DISEASE

Coronary heart disease (CHD), or coronary artery disease (CAD), means atherosclerotic arterial deposits are blocking blood flow to the heart. CHD independently caused 1 in every 7 deaths in the United States in 2011,

The Assessment of $VO_2\text{max}$ With a Graded Exercise Test



MODELS: KURT ESCOBAR AND LUDMILA MALAKHOV. PHOTOGRAPHER: JACOB COVELL



Combating 35 Health Problems

Regular physical activity and exercise are a primary prevention factor for 35 chronic health conditions (Booth, Roberts & Laye 2012).

and an estimated 635,000 Americans have a new coronary attack each year (Mozaffarian et al. 2015).

Although CHD cannot be fully prevented, being physically fit substantially lowers the risk. Ribeiro et al. (2010) say that endothelial dysfunction (disruption in the inner lining of blood vessels) and inflammation have become promising targets in the effort to prevent CHD. The majority of studies report that exercise training, particularly aerobic exercise, promotes improvements in endothelial cell function and lowers the level of inflammatory markers (Ribeiro et al. 2010). Ribeiro and colleagues state that aerobic-interval exercise is even better than moderate-intensity aerobic exercise for increasing endothelial function.

PERIPHERAL ARTERY DISEASE

Peripheral artery disease (PAD) is characterized by a narrowing of the arteries, which reduces blood flow; PAD affects about 8.5 million Americans over age 40 and is especially common in the legs of physically inactive people (Mozaffarian et al. 2015).

Risk factors for PAD are similar but not identical to those for CHD. Diabetes and cigarette smoking are stronger risk factors for PAD than for CHD (Booth, Roberts & Laye 2012). PAD impairs lower-extremity function and diminishes quality of life. McDermott et al. (2006) found that among patients with PAD, self-directed walking exercise at least three times weekly was associated with significantly less functional decline during the subsequent year.

- | | |
|--|--|
| 1. low cardiorespiratory fitness (VO ₂ max) | 15. diverticulitis |
| 2. coronary heart disease | 16. constipation |
| 3. endothelial dysfunction | 17. gallbladder disease |
| 4. peripheral artery disease | 18. accelerated biological aging/premature death |
| 5. hypertension | 19. type 2 diabetes (including insulin resistance and prediabetes) |
| 6. stroke | 20. metabolic syndrome |
| 7. congestive heart failure | 21. obesity |
| 8. osteoporosis | 22. colon cancer |
| 9. osteoarthritis | 23. breast cancer |
| 10. rheumatoid arthritis | 24. endometrial cancer |
| 11. depression | |
| 12. anxiety | |
| 13. cognitive dysfunction | |
| 14. nonalcoholic fatty liver disease | |

>> While the conditions below are not discussed in the article or are mentioned only briefly, there is evidence that physical activity is helpful in their prevention as well:

- | | |
|-------------------------------|-------------------------------------|
| 25. sarcopenia | 32. erectile dysfunction |
| 26. balance problems | 33. hemostasis (blocked blood flow) |
| 27. bone fracture/falls | 34. deep vein thrombosis |
| 28. dyslipidemia | 35. pain |
| 29. pre-eclampsia | |
| 30. gestational diabetes | |
| 31. polycystic ovary syndrome | |

FIGURE 1.

Major Consequences of Physical Inactivity



Proneness to visceral obesity, type 2 diabetes and metabolic syndrome

Weaker immune system

Less executive control of the central nervous system; memory decline

Sarcopenia & loss of strength

Reduced skin-wound healing

Lower oxidative capacity

Higher risk of Alzheimer's disease, dementia, depression and anxiety

Artery stiffness

Higher risk of breast, endometrial and colon cancer

Elevated risk of osteoporosis

Loss of coordination and balance (higher risk of fracture/falls)

Elevated risk of stroke, coronary heart disease and peripheral artery disease

Decreased function of joints, ligaments and tendons

Hypertension, elevated LDL (bad) cholesterol, low HDL (good) cholesterol

Increased risk of non-alcoholic fatty liver disease

SOURCE: BOOTH, ROBERTS & LAYE (2012).

HYPERTENSION

Hypertension represents a systolic blood pressure level of 140 millimeters of mercury (mm Hg) or more or a diastolic BP of 90 mm Hg or more ("prehypertension" means systolic BP is 120–139 mm Hg and diastolic BP is 80–89 mm Hg).

Hypertension is associated with shorter overall life expectancy, which at age 50 is 5.1 years longer for men who have normal blood pressures and 4.9 years longer for women, compared with adults of the same age who have high blood pressure (Mozaffarian et al. 2015).

Physical activity is crucial to preventing hypertension. Millar & Goodman (2014) summarize research showing that 30–60 minutes of moderate to vigorous exercise 4–7 days per week leads to a decrease in systolic blood pressure (6.9–8.3 mm HG) and in diastolic blood pressure (4.9–5.2 mm HG) for hypertensive patients.

STROKE

Booth, Roberts & Laye (2012) define stroke as a sudden reduction or loss of sensation, consciousness and voluntary motion, caused by a blood clot or burst blood vessel in the brain. Mozaffarian and colleagues (2015) note that women have a higher lifetime risk of stroke than men. When stroke is considered separately from other CVDs, it ranks fourth among all causes of death, behind heart disease, cancer and chronic lower respiratory disease (Mozaffarian et al. 2015).

Booth, Roberts & Laye underscore that the most physically active adults have a 25%-30% lower risk for stroke incidence and mortality. Reimers, Knapp & Reimers (2009), from their review of the literature, recommend regular moderate to high-intensity cardiovascular exercise for at least 30 minutes per day to prevent stroke.

CONGESTIVE HEART FAILURE

Congestive heart failure (CHF) happens when the heart does not pump enough blood through the arteries and into the tissues. It is marked by blood backing up in various parts of the body, especially the lungs and feet. After age 65, approximately 10 in 1,000 people have CHF (Booth, Roberts & Laye 2012).

Booth and colleagues say that randomized controlled research on the effect of exercise with CHF patients is not available, but they conclude that observational data supports the view that regular endurance training can help prevent the development of CHF.

3 Bone and Joint Diseases OSTEOPOROSIS

Osteoporosis is a decrease in bone mass and mineral density that makes the bones more porous and brittle.

Physical inactivity is among the main osteoporosis risk factors, which also include family history, age, low body weight, smoking, excessive alcohol consumption, inadequate calcium intake, inadequate vitamin D intake, low reproductive hormone levels and medications/drugs affecting bone metabolism (Rector et al. 2009).

Rector and colleagues say the best osteoporosis interventions are weight-bearing endurance exercises, jumping activities, and resistance exercise that targets all major muscle groups. The researchers also suggest that a resistance training program designed to increase lean body mass will help people whose primary modes of exercise are not impact-aerobic activities.

Because the body is prone to adaptation, only bones subject to loads will become stronger. Dynamic exercise alters the balance between bone formation and resorption (by which specialized osteoclast cells break down old bone cells to make way for osteoblasts to stimulate new bone growth) (Booth et al. 2012). A mixed-loading exercise program that combines jogging and other low-impact loading activity with moderate to high-intensity resistance exercise (of major muscle groups) is effective in preventing and reducing osteoporosis risk (Booth, Roberts & Laye 2012).

OSTEOARTHRITIS

Osteoarthritis (OA) is the degeneration of cartilage and the underlying bone within a joint. Many popular sports and activities increase the incidence of OA. Sports, games and other activities that put high levels of impact and torsional loading (stress from one end of a bone being twisted while the other end does not move) on joints increase the risk of this injury-induced joint degeneration. Such activities include ballet/modern dance, running, basketball, soccer, hockey and tennis.

Booth, Roberts & Laye (2012) say 30–60 minutes of regular, moderate-to-vigorous exercise (with minimal torsional loading) appears to be best for OA prevention.

RHEUMATOID ARTHRITIS

Rheumatoid arthritis (RA) is a chronic autoimmune disease characterized by inflammation of joints, frequently accompanied by deformities (Booth, Roberts & Laye 2012). Patients with RA have increased morbidity and mortality from cardiovascular disease, largely due to accelerated atherosclerosis. Researchers feel this is due to systemic inflammation rather than traditional cardiovascular risk factors.

In their research review of exercise and RA, Cairns & McVeigh (2009) suggest that the majority of patients with RA should be encouraged to try aerobic and/or strength training exercise. Exercise programs should be carefully designed for the individual, particularly for patients with underlying large-joint damage or cardiovascular disease. >>

Clarifying Key Health and Fitness Terms

Common health and fitness terms may seem interchangeable, but there are differences, which are clarified below:

Chronic disease. Booth, Roberts & Laye (2012) define a chronic disease as an ailment slow in its progress (i.e., decades) and long in its continuance, as opposed to an acute disease, which has a swift onset and short duration.

Exercise. “A subcategory of physical activity that is planned, structured, repetitive and purposive in the sense that the improvement or maintenance of one or more components of physical fitness is the objective” (CDC 2015).

Health. “A human condition with physical, social and psychological dimensions, each characterized on a continuum with positive and negative poles. Positive health is associated with a capacity to enjoy life and to withstand challenges; it is not merely the absence of disease” (CDC 2015).

Maximal functional capacity. Booth, Roberts & Laye (2012) explain that maximal functional capacity is the upper limit of a cell, tissue, system or body to maintain homeostasis when under stress.

Physical activity. “Any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level” (CDC 2015).

Physical inactivity. “Physical activity levels less than those required for optimal health and prevention of premature death” (Booth, Roberts & Laye 2012).

Physical fitness. “The ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and respond to emergencies.” This includes cardiorespiratory endurance, muscle endurance, muscle strength, muscle power, flexibility, balance,



4 Depression, Anxiety and Cognitive Dysfunction

DEPRESSION AND ANXIETY

Depression is a mood disorder marked by sadness, while anxiety is an abnormal sense of apprehension and fear, often accompanied by physiological changes such as sweaty palms and elevated heart rate (Booth, Roberts & Laye 2012). Depression is relatively common and expensive to treat in the U.S. About 8% of women and 4% of men are affected (Booth, Roberts & Laye 2012).

Several studies have found that physically active people are less likely to suffer from depression. Babyak et al. (2000) assessed the status of 156 adult volunteers with major depressive disorder 6 months after completion of a study in which they were randomly assigned to a 4-month course of aerobic exercise, drug therapy, or a combination of exercise and sertraline. The study found that a modest exercise program (e.g., 30 minutes at 70% of maximum heart rate reserve, 3 times per week) is an effective treatment for patients with major depression.

Even short-term exercise intervention can alleviate depression (Dimeo et al. 2001). Subjects followed a treadmill interval-training program 30 minutes a day for 10 days (1 day off on Sunday). The interval program consisted of 3 minutes of treadmill walking at a “somewhat hard” rating of perceived exertion (RPE) alternating with 3 minutes of recovery at half the speed of the work interval. Results suggest that aerobic exercise

produces substantial improvement in mood in patients with major depressive disorders.

Anxiety has an incidence rate of about 10% in the U.S.; if it lasts more than 6 months, sufferers often resort to drug and alcohol abuse (Booth, Roberts & Laye 2012). Mozaffarian et al. (2015) note that higher levels of anxiety symptoms are associated with increased risk of incident stroke.

In a research review, Ströhle (2009) points out that systematic studies on how to best deal with anxiety-related symptoms are lacking. Ströhle recommends that people suffering with anxiety disorders follow the exercise guidelines that improve quality of life in healthy adults.

COGNITIVE DYSFUNCTION

Cognitive functions encompass brain activities that lead to knowledge, reasoning, memory, attention and language for acquiring information. Research reviewers Hillman, Erickson & Kramer (2008) state that aerobic exercise and physical activity improve cognitive health across the lifespan. They say that in children, exercise not only improves physical health but may also improve academic performance.

Researchers have many unanswered questions about the effects of exercise on cognition as people age. However, there’s evidence linking fitness training to improvements in various aspects of cognition across a broad range of ages.



FIGURE 2.

Specific Benefits of Resistance Training



Increase in resting metabolic rate

Improvement in self-esteem and self-concept

Improvement in resting systolic and diastolic blood pressure levels if initially elevated

Increase in bone mineral density in specific sites that are trained

Improvement in blood lipid profile, including lower triglycerides,

Nonalcoholic Fatty Liver Disease, Accelerated Aging and Digestive Tract Diseases

NONALCOHOLIC FATTY LIVER DISEASE (NAFLD)

Nonalcoholic fatty liver disease (NAFLD) is a progressive, developing disease occurring in people who drink < 10 grams (females) or < 20 g (males) of alcohol per day (Booth, Roberts & Laye 2012). Essentially, fat is deposited in the liver owing to causes other than excessive alcohol use. Booth, Roberts & Laye say that the prevalence of NAFLD in American children is estimated at 13%, and that it has emerged as the leading cause of chronic liver disease in adolescents and children in the United States.

It is most fortunate, therefore, that Caldwell & Lazo (2009) note that physical activity provides health benefits to fatty liver disease sufferers and, best of all, the activity is independent of changes in body weight. They say physical conditioning appears to be closely linked with improved hepatic metabolism, which is independent of changes in body weight.

ACCELERATED BIOLOGICAL AGING AND PREMATURE DEATH

Booth, Laye & Roberts (2011) describe aging as the inevitable decline of cellular structure and function, independent of disease processes. Secondary aging, meanwhile, describes processes that result from disease or bodily abuse/disuse. Secondary aging factors like inactivity are often preventable.

Booth, Roberts & Laye (2012) say aging-research data strongly supports an inverse relationship between physical activity and all causes of mortality. The authors say inactivity affects almost every cell, organ and system in the body, causing sedentary dysfunctions that

Improvement in resting systolic and diastolic blood pressure levels if initially elevated

Enhanced physical function in relation to activities of daily living

higher HDL cholesterol and lower LDL cholesterol (according to some research)

Slowing of sarcopenia and age-related factors in skeletal muscle

Heightened cognitive abilities

Improvement in insulin sensitivity and glycemic control

Better management and control of depression

SOURCE: WESTCOTT (2015).

accelerate death. The risk of dying is approximately 30% lower in active adults (Booth, Roberts & Laye 2012) than it is in inactive people.

DIGESTIVE TRACT DISEASES

The digestive tract includes all accessory organs of digestion. Observational research has shown that diverticulitis (inflammatory swelling of an abnormal pouch in the intestinal wall), constipation and gallbladder disease can be caused by inactivity, and that physical activity and exercise may help to prevent them.

Insulin Resistance and Diabetes, Metabolic Syndrome and Obesity

INSULIN RESISTANCE AND DIABETES

Insulin resistance and insensitivity are defined by Booth, Roberts & Laye (2012) as the reduced capability of skeletal muscle and liver cells to respond to the action of a



given dose of insulin by transporting glucose from the bloodstream into the tissues. If not reconciled, over a period of years this will turn into prediabetes (fasting blood glucose level between 100 and 125 milligrams per deciliter) and then into overt type 2 diabetes.

It is important to be aware that physical activity can set back insulin resistance and prediabetes (Booth, Roberts & Laye 2012). However, microvascular damage from chronically elevated blood glucose in type 2 diabetes does not appear to be reversible. Booth, Roberts & Laye 2012 project that by the year 2020, half of all Americans will have prediabetes or diabetes, which is alarming, since this is almost entirely preventable with a healthy diet, regular physical activity and exercise.

METABOLIC SYNDROME

Metabolic syndrome is a cluster of three to five of the following risk factors for cardiovascular disease and type 2 diabetes (Mozaffarian et al. 2015):

- fasting plasma glucose ≥ 100 mg/dL, or undergoing drug treatment for elevated glucose
- HDL cholesterol < 40 mg/dL in men or < 50 mg/dL in women, or undergoing drug treatment for reduced HDL cholesterol

- triglycerides ≥ 150 mg/dL, or undergoing drug treatment for elevated triglycerides
- waist circumference > 102 cm in men or > 88 cm in women for people of most ancestries living in the United States
- blood pressure ≥ 130 mm Hg systolic or ≥ 85 mm Hg diastolic, or undergoing drug treatment for hypertension

Mozaffarian et al. (2015) say that in 2009 to 2010, 23.7% of men and 21.8% in women in the U.S. had metabolic syndrome. According to Booth, Roberts & Laye (2012), metabolic syndrome is becoming hyperendemic, meaning it has a high prevalence around the world.

Booth, Roberts & Laye (2012) say that physical inactivity is a primary cause of each of the metabolic syndrome risk factors, and that physical activity and exercise are primary prevention strategies for these risks.

OBESITY

More than one-third (34.9%) of adults in the U.S. are obese (BMI ≥ 30) (Ogden et al. 2013). Middle-aged adults (aged 40–59) have higher obesity rates than young adults (aged 20–39) and older adults (aged 60 or older) (Ogden et al. 2013).

Booth, Roberts & Laye (2012) note that daily physical activity levels are dramatically different today than they were in the Paleolithic Era (stone age) of 20,000 years ago. For example, Booth, Roberts & Laye (2012) estimate that men and women now walk about 5,340 and 4,912 steps per day, respectively—a dramatic drop from the Paleolithic period, when they walked 13,200–21,120 steps and 10,560 steps per day, respectively.

Booth, Roberts & Laye (2012) say there is no way we can revert to our natural way of life. Instead, we must use this insight into our biological heritage to combat current trends in obesity by increasing physical activity and reducing caloric intake.

7 ■ **Cancer**

Cancer is a malignant tumor with unlimited potential for growth via mitosis (single cells dividing into identical daughter cells), expanding locally and then systematically by metastasis (the process of spreading to another place in the body) (Booth, Roberts & Laye 2012).

Booth and colleagues say some cancer types are not caused by lack of physical activity, although a few,

including colon, breast and endometrial cancers, are linked to a higher prevalence of inactivity.

Harriss et al. (2007) state that physical inactivity may be responsible for 13%–14% of colon cancer cases. The authors add that epidemiological research suggests an association between physical activity and reduced risk of colon cancer, although studies are inconclusive for rectal cancer. Booth, Roberts & Laye (2012) add that their synthesis of the research indicates that people in the highest physical activity category have roughly a 40%–50% lower risk of colon cancer compared with those in the least active category.

Booth, Roberts & Laye (2012) link physical activity with a moderate reduction (20%) in breast cancer incidence. They add that the effect differs for pre- and post-menopausal women, with the risk reduction appearing to be a stronger among postmenopausal women.

In a meta-analysis of studies, Moore et al. (2010) found that physical activity was clearly associated with a 30% lower risk of endometrial (of the mucous membrane lining the uterus) cancer in physically active women as compared with inactive women. The authors concluded that the evidence persuasively shows that physical activity reduces the risk of endometrial cancer.

Final Thoughts

Physical inactivity elevates the likelihood of physical frailty or premature death, decreases years of high-quality life, lowers cardiorespiratory reserve to handle physiological stresses (such as major surgery) and heightens the risk of chronic diseases (Booth, Roberts & Laye 2012).

Fitness professionals have the knowledge and skills to help clients combat these wide-ranging health consequences. As an industry, we need to proactively create new ways to add daily physical activity to our lives and encourage everybody to exercise. The results could be immense. Let's do it! ■

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