

Movement for Health

Everyone knows that regular physical activity is good for health, helping the mind and body to function best and in harmony. Conversely, a lack of regular physical activity, or a **sedentary lifestyle** (from the Latin *sedere*, meaning to sit), contributes to ill-health, including an increased risk of heart disease, overweight, type 2 diabetes, high blood pressure, osteoporosis, some forms of cancer, and other illnesses. A sedentary lifestyle is also associated with nearly 15% of premature deaths among Americans, particularly deaths related to heart disease and overweight .

Worldwide, nearly 60% of adults lead sedentary lives (many people work while sitting), which contributes to hundreds of millions of cases of chronic disease and millions of premature deaths each year. About 50% of American adults, including college students, do not get recommended amounts of physical activity, which means they exercise at home, school, work, or during leisure time for less than 30 minutes a day on most days of the week.

For 99% of the many thousands of years that humans have inhabited the earth, adults have had to walk, run, lift, bend, and carry in order to find and raise their own food, provide themselves with shelter, raise children, and protect themselves. However, starting about 200 years ago and accelerating greatly in the 20th century, people began using machines to carry out all manner of activities. Now, most of the North American labor force works in occupations that involve sitting at a desk, standing behind a counter, or occasionally walking a few steps while tending to others' needs and requests. And regardless of the type of work, over 90% of Americans travel to their jobs while sitting in a car. Furthermore, when they get home, even if they have few household tasks to do, many people watch TV, play video games, or interact with the Internet rather than move their bodies (other than to go to the refrigerator). It is estimated that people living in modern, industrialized societies expend almost half as much energy each day carrying out the tasks of living than ancient humans did.

The integration of work-saving machines into the fabric of modern life has had the inadvertent consequence of increasing risks to health from too little physical activity. Thus, to be healthy, people *must* engage in some form(s) of movement during non-paid/non household work time – not easy for those whose schedules are overfull and/or who hate the word “exercise” and disdain anything that causes them to breathe hard and sweat.

Recognizing that physical inactivity is detrimental to health, many countries, communities, health professionals, public health organizations, schools, employers, and religious organizations are seeking ways to encourage people to be more physically active. For example, governmental bodies have made engaging in physical activity national goals and are developing programs that encourage individuals to devote 30 minutes a day to some

sort of movement activity; new housing developments are required to include inviting public spaces, parks, walking and biking paths, and close access to public transportation and shopping to minimize driving; and employers are offering employees training and time at work to engage in various types of physical activities and encouraging employees to increase activity by placing parking lots some distance from buildings, giving employees pedometers, resetting elevators to run slowly, and making staircases wide, carpeted, brightly painted, and with picture windows.

THE DEFINITION OF PHYSICAL ACTIVITY

Physical activity is anything you do when you are not sitting or lying down, from clicking your computer's mouse to running a marathon. Among Americans and residents of developed countries, physical activity occurs when doing household tasks, in work-related movement, leisure-time activities, and skill-based, performance activities.

Physical activity is scientifically defined in terms of the amount of energy expended to produce movement. Movement occurs when energy derived from food is utilized by muscles that are connected to bones to shorten (*concentric contraction*) or lengthen (*eccentric contraction*). When muscles shorten or lengthen, the bones they are attached to move, and so do you.

Energy for movement is derived principally from carbohydrate and fat -- and on occasion the amino acids in protein, but not vitamins and minerals -- which the body acquires from food and can store until needed if necessary. There are four calories of energy in a gram of carbohydrate and protein and nine calories of energy in a gram of fat. Energy can be derived from food with or without the addition of oxygen. Oxygen-absent energy production is called **anaerobic**; oxygen-present energy production is called **aerobic**. Compared to oxygen-absent, oxygen-present energy production is nearly 20 times more efficient, which is the major reason you breathe.

Oxidation is the chemical term for the process of oxygen-present energy production. *Burning* is another term for the process of oxidation. When biological material is "burned" in a fire, oxidation generates very little useful energy and considerable heat. When carbohydrate and fat are "burned" in cells, oxidation is controlled to capture the energy for useful work and to minimize energy lost as heat. So, when you hear the expression "burn calories," it means extracting energy to fuel cellular processes and not setting something afire.

The nervous system controls movement by signaling muscles to contract. Some movements are *reflexive*, meaning they do not require a conscious decision, for example, when quickly pulling your hand from a hot stove. A *voluntary movement* involves both decision- and movement-control centers in the brain, which send nerve signals to specific muscles resulting in movement.

Any movement or activity can be discussed in terms of the following (FITT) dimensions: **F**requency, how often the movement or activity occurs; **I**ntensity, the energy required to render the movement or activity; **T**ime, how long the movement or activity takes place; **T**ype or mode, the kind of movement or activity. For example, you can walk (*type*) for 10 minutes (*time*) to a particular class three times a week (*frequency*) at a pace utilizing four calories per minute (*intensity*). Thus, each walk to class utilizes 40 calories of energy, with a resulting expenditure of about 120 calories per week. (10 minutes x 4 calories per minute).

PHYSICAL ACTIVITY FOR HEALTH

Many studies show that moderate amounts of regular physical activity, whether it is household, work-related, leisure time, or performance-enhancing, counteracts the deleterious effects of sedentariness and contributes to health and well-being in a variety of ways. A moderate amount of physical activity expends between 1.4 and 1.7 times the energy required for basal metabolism, which for most people amounts to 120 and 300 calories per day of activity, or a total of about 600-1500 calories per week.

The scientifically-based finding that moderate levels of physical activity are beneficial to health stands in stark contrast to the exhortations of the health club, exercise equipment, dietary supplement, and fashion industries, and the advertising, popular magazines, and TV infomercials that support them, which would have people believe that physical activity for health requires considerable time, energy, special equipment and clothing, painful effort, and sweating a lot in order to attain a svelte, lean body (and for men one that is highly muscular or “cut”) -- appearances more suited to computer-enhanced images than real people. You do not have to run like an Olympic athlete or look like a model in a fitness advertisement to be healthy.

An efficient way to attain a moderate level of physical activity is to walk briskly for 30-45 minutes on most days of the week. Your pace should be such that your heart and breathing rates increase slightly but not so much that you could not carry on a conversation while walking; for most people, this pace is about 3-4 miles per hour. Also, you should experience a light to moderate increase in **relative perceived exertion**, which is awareness of one's relative response to exercise (sensations of effort and muscular force, breathing rate, body and skin temperature).

Although it seems tame in comparison to running on a treadmill, walking is nevertheless excellent for health. It strengthens the heart and skeletal muscles, increases breathing ability, clears and quiets the mind, reduces stress, uses calories (weight maintenance), and causes few injuries, if any. Other than appropriate shoes, walking requires no special clothing or equipment, and with a little preplanning, can be worked into any busy schedule; you can break

up the total walking time into several, small parts and attain the same health benefits. Walk stairs instead of riding an elevator, park the car 10 minutes from your destination and walk the rest of the way, take a dog for a walk twice a day (Fido will be forever grateful), do a walk-talk with a friend, family member, or spouse (good for relationship maintenance and also fun), and make it a habit to walk around while you talk on your mobile phone.

Many people find that counting their daily steps with a pedometer or mobile app helps keep them focused on walking. An average sized person takes 2000 steps to walk a mile. Health experts recommend taking a total of 10,000 steps per day in all one's activities combined -- 15,000 if possible -- and keeping a step-count diary that records not only the number of steps you take but also any obstacles that prevented you from walking as much as you wanted to.

People who enjoy vigorous physical activities (e.g., running, lap-swimming, singles tennis), should do them at least three days a week for 20 minutes each time. Vigorous activities utilize seven or more calories per minute, make you breathe hard and sweat, and are sufficiently intense that you could not talk to anyone while doing them. Compared to moderate physical activity, vigorous physical activity provides slightly greater heart-health benefits and longevity. However, it also carries a higher risk of physical injury and psychological burn out, either of which can curtail activity for weeks or even months.

Besides direct effects on health, both moderate and vigorous physical activity can provide time and attention for you. Many people feel overwhelmed by the demands of school, jobs, and family. Just taking a few minutes several days a week to move your body can give you a chance to relax, reflect, and indulge your imagination. Also, physical activity can improve mental functioning and contribute to enhanced work performance.

COMPONENTS OF PHYSICAL ACTIVITY

Although your whole being responds to movement, it is possible to identify the following six components of physical activity:

1. Motivation...the willingness to focus attention and energy on movement.
2. Cardiorespiratory fitness...the body's ability to obtain and utilize fuel and oxygen efficiently during sustained, effortful, physical activity.
3. Body strength...the ability to lift or move an object (including your body, as when you walk or climb stairs).
4. Endurance...the ability to move an object (including yourself) without becoming quickly fatigued.
5. Flexibility...the ability to move a joint (where two bones meet) through its anatomical range of motion.

6. Body composition...the body's relative amounts of water, bone, fat, and tissue.

These six components and activities that promote them are discussed below.

Motivation

Your ancient ancestors did not require specific motivation to be physically active. Because they had to move their bodies to acquire food and avoid environmental dangers, hunger and fear were motivation enough for movement. Most modern humans can eat and be safe without much daily movement; indeed, many occupations require little movement. Thus, to gain the health benefits from movement, other motivations must come into play, such as being paid, such as in an employer-sponsored exercise class, the desire to be healthy, to “look good,” to enjoy socializing while engaged in a movement activity, and to accomplish a personal goal, such as losing weight, climbing a mountain, running a distance race, or biking 50 miles.

Regardless of the motivation, it is important that one's chosen physical activities be enjoyable, or at the very least, not objectionable. Doing enjoyable activities promotes continuing with them. If what you do is unpleasant, however, you won't do it for very long. This might mean experimenting with several types of activities in order to find ones that you are likely to make a regular part of your life. It might mean engaging in more than one activity to break up monotony and boredom. **Cross-training** is incorporating more than one activity in your regular activity plan, for example, walking four days a week and doing strength training or cycling two days a week (and resting one day).

Also, it is important to realize that obstacles to accomplishing one's movement goals arise frequently. Regardless of your motivation and dedication, there may be weeks or even months when getting your desired level of physical activity is a challenge. Perhaps you get sick or injured. Perhaps your schedule is very tight and there seems to be no time for anything but work. Perhaps you lose interest in former activities. At such times it is important not to become so discouraged that you give up wanting physical activity in your life. Realize that obstacles are to be expected and that they will pass in time. And when they do, you can resume your desired activities or replace them with better alternatives.

Cardiorespiratory Fitness

Cardiorespiratory fitness is the degree to which the body can supply sufficient fuel (carbohydrate, fatty acids, and oxygen) to produce sustained, effortful, physical activity, in other words, the degree to which someone is “in shape.” Exercise physiologists define cardiorespiratory fitness in terms of the maximum amount of oxygen the

body can utilize in physical activity, called VO_2^{*max} (“volume of oxygen* maximal”). Studies show that higher fitness levels, defined by VO_2^{*max} , are associated with a lower risk of death from cardiovascular disease. It is not known how cardiorespiratory fitness reduces the risk of heart disease; one suggestion is that it lowers blood levels of total and “bad” cholesterol and triglycerides, which are progenitors of heart disease. Cardiovascular fitness also lowers the heart rate. Because modern lifestyles do not require vigorous physical activity in the carrying out of daily life tasks, attaining high levels of cardiorespiratory fitness requires planned bouts of sustained, high-intensity, vigorous activity, called **aerobic training**.

Body Strength

Body strength is the ability of a muscle or group of muscles to move an object, including your body. Whereas it often conjures up images of super-muscular body builders lifting heavy weights, body strength for health requires minimal, if any, change in body size and lifting weights. The goal is to have sufficient strength to carry out normal tasks (work, lifting packages, walking stairs, shoveling snow) and participate in physical activities without injury. Two popular ways to increase body strength are strength training and Pilates.

Endurance

Endurance is the ability to move an object, including yourself, without becoming quickly fatigued. Endurance is a combination of fitness, strength, and motivation. The fitness aspects of endurance relate to the body’s ability to acquire and utilize oxygen, carbohydrate, and fat to fuel movement for an extended period of time. The strength aspect of endurance involves having sufficiently strong muscles to carry out an activity for an extended period without damage. The motivational aspect of endurance is the will to carry on with an activity even though you feel fatigued.

Endurance develops by extending yourself past former limits of physical activity. In this way, the anatomy and physiology of the heart, lungs, muscles, energy supplying and utilizing systems, and your own expectations of your ability to persevere gradually adapt to meet the challenges of extended activity. Endurance training generally involves both aerobic and strength training activities.

Flexibility

Flexibility is the degree to which you can rotate, bend, and twist a part of your body. Rotating, bending, and twisting occur where bones meet, an anatomical structure called a *joint*. For example, your elbow is a joint at which the two lower arm bones attach to the upper arm bone, allowing you to bend your arm. Imagine how arm movement

would be if you had no elbow joint.

Joints are held together by ligaments and tendons, which are elastic, fibrous bands of *connective tissue*. Flexibility is determined by the pliability of a joint's connective tissue and associated muscles. Every joint has a **range of motion**, which is the amount of rotating, bending, or twisting that the anatomy of the joint allows. Satisfactory flexibility is being able to move a joint through its full range of motion. Satisfactory flexibility lessens the effort in carrying out physical asks, such as lifting a package or bending to pick up something, fosters good balance, which aids mobility and reduces the risk of falling, reduces bodily and psychic tension resulting from stress, lessens the risk of low back pain, reduces exercise-associated soreness, improves blood flow to muscles, and lessens the risk of activity-related injuries.

Movement at a joint can increase its flexibility; lack of movement can reduce it. That is one reason that exercisers feel "loose" after activity and sedentary people tend to feel stiff and have difficulty bending. Flexibility at particular joint can be fostered by specific stretching exercises. Each joint's flexibility is independent of other joints, that is, you can be more flexible at one joint than you are at another. Activities such as yoga and tai chi ch'uan, which are discussed below, help increase flexibility at many joints simultaneously.

Body Composition

Body composition refers to the relative amounts of the body's major constituents, that is, water, protein (called the *fat free mass*), minerals, including the calcium and phosphate in bones, and essential and storage fat. Two health concerns relating to body composition are body fat percentage and bone density.

Body fat percentage. The body has two kinds of fat, essential fat to carry out life functions and storage fat to supply energy. The healthy range for the amount of storage fat for non-athletic, young adult males is between 10% and 20% of the total body weight. Because of differences in sex hormone biology, the healthy range for the amount of storage fat for non-athletic, young adult females is 15%-30% of the total body weight. Greater or lesser body fat percentages can be a risk to health.

Bone density. Healthy bone density is about 4% of total body weight; low bone density, such as in osteoporosis, increases the risk of falls and bone fracture. Healthy bone density is achieved by engaging in regular weight-bearing exercise, consuming adequate amounts of calcium and phosphate, and consuming little or no phosphate-containing sodas. Bone density is largely determined when one is young, which is the reason young people are encouraged to exercise, consume dairy foods, and not to consume sodas.