UNIT TWO

THE HEALTH BENEFITS OF PHYSICAL ACTIVITY

2.1. Physical Activity and Hypokinetic Diseases/ Conditions

Hypokinetic diseases are conditions related to ***inactivity*** or low levels of habitual activity.

The term —hypokinetic is now widely accepted and can be used to describe many of the diseases and conditions associated with ***inactivity and poor fitness***.

Physical inactivity has led to a rise in chronic diseases. Some experts believe that physical inactivity is the most important public health problem in the 21st century. Each year at least ***1.9 million*** people die as a result of physical inactivity.

Data from the Aerobics Center Longitudinal Study (2009) indicated that low cardiorespiratory fitness accounts for substantially more ***deaths (16%) compared*** to other risk factors (i.e., ***obesity 2–3%; smoking 8–10%; high cholesterol 2–4%; diabetes 2–4%; and hypertension 8–16%).*** Individuals who do not exercise regularly are at a greater risk for developing chronic diseases such as ***coronary heart disease (CHD), hypertension, hypercholesterolemia, cancer, obesity, and musculoskeletal disorders***

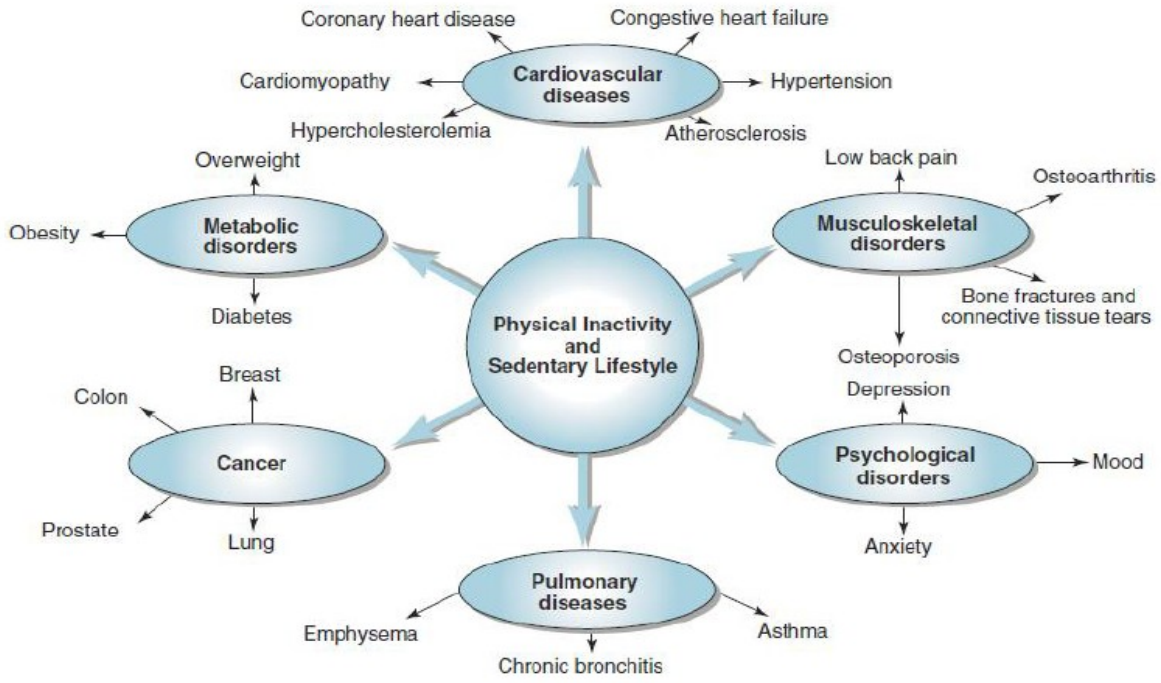


Figure 1.1 Role of physical activity and exercise in disease prevention and rehabilitation.

In 1995, Center for Disease Control (CDC) and the American College of Sports Medicine (ACSM) recommended that every adult should accumulate ***30 min*** or more of moderate-intensity physical activity on most, preferably ***all, days of the week.***

American Heart association (AHA) and the ACSM updated physical activity recommendations for healthy adults and older adults.

For adults ***(18–65 yr)*** and older adults ***(>65 yr),*** the ACSM recommends

- a minimum of ***30 min*** of ***moderate***-intensity ***aerobic*** activity ***5 days*** per week
- or ***20 min*** of ***vigorous***-intensity ***aerobic*** exercise ***3 days*** per week.

They also recommend moderate- to high-intensity

- ***8- to 12*** repetition maximum (RM) for adults and
- ***10- to 15-RM*** for older adults ***resistance*** training for a minimum of ***2 nonconsecutive*** days per week.
- ***Balance and flexibility*** exercises are also suggested for older adults.

For substantial health benefits, adults should engage in aerobic exercise at least

- ***150 min*** per week at a ***moderate intensity*** or
- ***75 min*** per week at a ***vigorous intensity***. In addition, adults and older adults should do ***muscle-strengthening*** activities at least ***2 days*** per week.

Children should do at least ***60 min of physical activity every day***. Most of the 60 min per day should be either ***moderate or vigorous aerobic*** activity and should include ***vigorous aerobic activities at least 3 days*** per week. Part of the 60 min or more of daily physical activity should be muscle strengthening activities (at least 3 days a week) and bone-strengthening activities (at least 3 days a week).

The term ***exercise deficit disorder (EDD)*** has been used to identify children who do not attain at least 60 min of moderate- to vigorous-intensity physical activity on a daily basis. Children having EDD may be susceptible to ***pathological*** processes associated with a physically inactive lifestyle.

Physical activity lowers the risk of hypokinetic conditions including

- dying prematurely,
- coronary artery disease,
- stroke,
- type 2 diabetes,
- metabolic syndrome,
- high blood lipid profile,
- cancers (colon, breast, lung, and endometrial), and
- hip fractures.

It also reduces

- abdominal obesity and
- feeling of depression and anxiety.

Physical activity helps in

- weight loss,
- weight maintenance and prevention of weight gain,
- prevention of fails, and improved functional health,
- improved cognitive function,
- increased bone density, and

- improved quality of sleep.

2.2. Physical Activity and Cardiovascular Diseases

According to World Health Organization (WHO, 2011) cardiovascular disease (CVD) caused ***17.3 million deaths (30%)*** worldwide in 2008, and it is projected to cause more than ***26 million deaths by 2030.*** More than 80% of those cardiovascular deaths occurred in low- and middle-income countries.

2.2.1 Coronary Heart Disease (CHD)

Globally, coronary heart disease (CHD) accounts for more deaths than any other disease, with more than ***7.6 million*** people dying from it in 2005 (WHO 2007). CHD is caused by ***a lack of blood supply to the heart muscle (myocardial ischemia***) resulting from a progressive, degenerative disorder known as atherosclerosis.

Atherosclerosis is an inflammatory process involving a buildup of

- low-density lipoprotein (LDL) cholesterol,
- scavenger cells (monocytes),
- necrotic debris,
- smooth muscle cells, and
- fibrous tissue.

This is how plaques form in the intima, or inner lining of the ***medium- and large-sized arteries*** throughout the cardiovascular system. As more lipids and cells gather in the plaques, they bulge into the arterial lumen. In the heart, these bulging plaques restrict blood flow to the myocardium and may produce angina pectoris, which is a temporary sensation of tightening and heavy pressure in the chest and shoulder region. A myocardial infarction, or ***heart attack***, can occur if a blood clot (thrombus) or ruptured plaque obstructs the coronary blood flow.

Coronary Heart Disease Risk Factors: Epidemiological research indicates that many factors are associated with the risk of CHD. The greater the number and severity of risk factors, the greater the probability of CHD. The positive risk factors for CHD are:

- Age,
- Family History,
- Hypercholesterolemia,

- Hypertension,
- Tobacco use,
- Diabetes Mellitus or Prediabetes,
- Overweight and Obesity, and
- Physical Inactivity.

Physical Activity and Coronary Heart: Disease Approximately ***6%*** of CHD deaths worldwide can be attributed to a lack of physical activity (WHO, 2010). Leading a physically active lifestyle may prevent 20% to 35% of cardiovascular diseases.

2.2.2 Hypertension

Hypertension, or high blood pressure, is a chronic, ***persistent elevation of blood pressure*** that is clinically defined as a

- systolic pressure ≥140 mmHg or
- a diastolic pressure ≥90 mmHg.

Individuals taking antihypertensive medicine also have this diagnosis. Prehypertension is a term used to describe individuals with

- a systolic pressure of 120 to 139 mmHg,
- a diastolic pressure of 80 to 89 mmHg, or both.

A clear link exists between hypertension and cardiovascular disease. WHO (2011) identified hypertension as the leading cardiovascular risk factor, attributing ***13% of deaths*** worldwide to high blood pressure. Hypertension is also the primary risk factor for all types of ***stroke.*** About ***15% to 40%*** of the global adult population has hypertension.

Regular physical activity prevents hypertension and lowers blood pressure in younger and older adults who are normotensive, prehypertensive, or hypertensive.

Exercise Prescription for Individuals with Hypertension (ACSM, 2013)

Mode: Primarily ***endurance activities supplemented by resistance*** exercises

Intensity: Moderate-intensity endurance (40–60% VO2R)* and

resistance training (60–80% 1-RM)

Duration: ***30–60 min*** or more of continuous or accumulated ***aerobic physical*** activity per day,

and a minimum of ***one set (8–12 reps)*** of resistance training exercises for each major muscle group.

Frequency: Most, preferably all, days of the week for aerobic exercise;

2 or 3 days/wk for resistance raining.

*VO2R is the difference between the maximum and the resting rate of oxygen consumption.

2.2.3 Hyper-cholesterolemia and Dyslipidemia

Hypercholesterolemia, is an ***elevation of total cholesterol (TC)*** in the blood, is associated with increased risk for CVD. Hypercholesterolemia is also referred to as hyperlipidemia, which is an increase in blood lipid levels; **dyslipidemia** refers to an ***abnormal blood lipid profile***. Approximately ***18% of strokes and 56% of heart attacks*** are caused by high blood cholesterol (WHO, 2002).

- Age,
- gender,
- family history,
- alcohol,
- smoking

are risk factors for hypercholesterolemia and **regular activity** reduced the chance of getting hypercholesterolemia and hyslipidemia.

Physical Activity and Lipid Profiles: Regular physical activity, especially habitual aerobic exercise, positively affects lipid metabolism and lipid profiles.

2.2.4 Diabetes Mellitus

Diabetes is a global epidemic. More than ***346 million*** people worldwide have the disease (WHO, 2011). Factors linked to this epidemic include urbanization, aging, physical inactivity, unhealthy diet, and obesity. At least ***65%*** of people with diabetes mellitus die from some form **of heart or blood vessel disease** (AHA, 2008). Diabetes is a major contributor toward the development of CHD and stroke. Also, diabetes is among the leading causes

of ***kidney failure; 10% to 20%*** of people with diabetes die of kidney failure (WHO, 2008).

Type 1, formerly referred to as ***insulin-dependent*** diabetes mellitus (IDDM), usually occurs before age 30 but can develop at any age.

Type 2, previously known as ***non-insulin-dependent*** diabetes mellitus (NIDDM), is more common; ***90%*** of individuals diagnosed with diabetes mellitus worldwide have type 2 diabetes (WHO, 2011).

- Age,
- gender,
- family history,
- calorie intake,
- physical inactivity

are risk factors for developing diabetes.

The effect of exercise alone as an intervention for people with type 2 diabetes is not well researched. However, exercise (30–120 min, 3 days/wk for 8 wk) produced clinically significant improvements in HbA1c and reduced visceral and subcutaneous adipose tissue stores in people with type 2 diabetes. Additionally, no adverse effects or diabetic complications resulting from exercise were reported (Thomas et al. 2006). Research that associates physical activity with weight loss, fat loss, and glycemic control suggests that regular physical activity reduces one's risk of developing type 2 diabetes. Both resistance and aerobic exercise alone or in combination improve HbA1c values in people with type 2 diabetes. The frequency of exercise is crucial for those with diabetes. If daily exercise is not possible, it should not be skipped 2 days in a row.

2.2.5 Obesity and Overweight

In clinical guidelines established by the Obesity Education Initiative Task Force of the National Institutes of Health and National Heart, Lung, and Blood Institute (1998), adult overweight and obesity are classified using the body mass index (BMI)

(BMI = weight [kg] / height squared [m2]).

- Individuals with a BMI between ***25 and 29.9 kg/m2 are classified as overweight***;
- Those with a BMI of ***30 kg/m2 or more*** are classified as ***obese.***

While WHO (2012) acknowledges the utility of BMI as a simple index of obesity, they also caution that it cannot account for the relative fatness of different individuals having the same BMI. Actually, they define overweight and obesity as having ***abnormal or excessive fat*** accumulation that may impair health. Regardless, overweight and obesity ranks as the fifth leading risk factor for death worldwide (WHO, 2012).

Globally, more than ***1 in every 10*** adults is obese (WHO, 2012). Originally overweight and obesity were considered to be problems of high-income countries; now, these conditions are on the rise in the low- and middle-income countries (WHO, 2012).

Excess body weight and fatness pose a threat to both the quality and duration of one's life. Obese individuals have a ***shorter life expectancy*** and greater risks of

- CHD,
- stroke,
- dyslipidemia,
- hypertension,
- diabetes mellitus,
- certain cancers,
- osteoarthritis,
- sleep apnea,
- abnormal menses, and
- infertility

(National Heart, Lung, and Blood Institute, 2012). Although obesity is strongly associated with CHD risk factors such as hypertension, glucose intolerance, and hyperlipidemia, the contribution of obesity to CHD appears to be independent of the influence of obesity on these risk factors.

Restricting caloric intake and increasing caloric expenditure through physical activity and exercise are effective ways of reducing body weight and fatness while normalizing blood pressure and blood lipid profiles.

2.2.6 Metabolic Syndrome

Metabolic syndrome refers to a ***combination of CVD risk factors associated with hypertension, dyslipidemia, insulin resistance, and abdominal obesity***. According to clinical criteria adopted by the National Cholesterol Education Program (2001), individuals with ***three or more CVD risk factors are classified as having metabolic syndrome***

Age and BMI directly relate to metabolic syndrome. Lifestyle must be modified in order to manage metabolic syndrome. The combination of healthy nutrition and increased physical activity is an effective way to increase HDL-C and to reduce blood pressure, body weight, triglycerides, and blood glucose levels.

2.2.7 Aging

A sedentary lifestyle and lack of physical activity ***reduce life expectancy by predisposing the individual to aging-related diseases*** and by influencing the aging process itself. With aging, a progressive loss of physiological and metabolic functions occurs; however, biological aging may differ considerably among individuals due to variability in genetic and environmental factors that affect oxidative stress and inflammation. Telomeres are repeated DNA sequences that determine the structure and function of chromosomes. With aging and diseases associated with increased oxidative stress (e.g., CHD, diabetes mellitus, osteoporosis, and heart failure), telomere length decreases. Thus, regular exercise benefits in retarding the aging process and diminishing the risk of aging-related diseases.

2.3 Physical Activity and Postural Deformity

Posture is the position from which ***movement begins and ends.*** Having proper postural alignment enables the body to perform movements quicker with less joint and muscular strain.

Why Good Posture Is Important

The body is designed to work at the most economical level, thus saving energy for future use. We spend more energy maintaining misaligned posture, which can cause ***muscle and joint pain.*** We compromise our body‘s integrity by not maintaining proper posture, resulting in decreased circulation; leading to varicose veins, muscle pain, joint pain, and many other conditions.

Women in general tend to develop poor posture because of many factors. They often have more clerical and computer oriented jobs that require sitting in a chair, eyeing a computer screen for long periods of time. They also wear high-heeled shoes, which lead to an alteration and compensation of their posture. The development of breast tissue or the augmentation of breasts can lead to many postural changes. Women also have less musculature to maintain proper alignment, leading to rounded shoulders, forward head

posture, hyper-extended knees, and increased thoracic and lumbar curves. Men can also develop all of these postural problems but at a different degree and rate depending on their situation.

To improve your posture and reduce structural damage, you should adhere to a corrective postural exercise program. This simple yet productive program will combat the effects of bad posture and help alleviate joint and muscle pain. Exercises for correcting posture:

- Prone Cobra
- Axial Extension Trainer
- Wall Leans
- Cervical Extension using a blood pressure cuff

2.3.1 Musculoskeletal Diseases and Disorders

Diseases and disorders of the musculoskeletal system, such as

- osteoporosis,
- osteoarthritis,
- bone fractures,
- connective tissue tears, and
- low back syndrome,

are also related to physical inactivity and a sedentary lifestyle. ***Osteoporosis*** is a disease characterized by the ***loss of bone mineral content and bone mineral density*** due to factors such as

- aging,
- amenorrhea,
- malnutrition,
- menopause, and
- physical inactivity.

It is becoming a major health issue, with an osteoporotic fracture occurring every 3 seconds worldwide. Wrist fractures precede the most common osteoporotic fracture, vertebral fractures.

However, hip fractures are the most devastating (International Osteoporosis Foundation 2009). Although osteoporotic fractures may occur in any bone, a hip fracture is recognized as a surrogate measure of the health care burden and expense due to osteoporosis, especially for men and women ≥50 yr.

Osteopenia, or low bone mineral mass, is a precursor to osteoporosis. More than one of every two adults aged 50 or older has either osteoporosis or osteopenia (National Osteoporosis Foundation, 2004).

Adequate ***calcium intake, vitamin D intake, and regular physical activity*** help counteract age-related bone loss. ACSM suggests the following exercise prescription to help counteract bone loss due to aging and preserve bone health during adulthood.

Exercise Prescription for Preserving Bone Health of Adults

Mode: Weight-bearing endurance activities (e.g., stair climbing, jogging), activities that involve

jumping (e.g., basketball, plyometrics), and ***resistance training***

Intensity: Moderate to high, in terms of bone-loading forces

Frequency: 3–5 times per week for weight-bearing endurance activities; 2 or 3 times per week

for resistance exercise

Duration: 30–60 min/day of a combination of weight-bearing endurance activities, activities

that involve jumping, and resistance training that targets all major muscle groups

Low back pain afflicts millions of people each year. More than 80% of all low back problems are produced by muscular weakness or imbalance caused by a lack of physical activity. If the muscles are not strong enough to support the vertebral column in proper alignment, poor posture results and low back pain develops. ***Excessive weight, poor flexibility, and improper lifting habits*** also contribute to low back problems. While some risks of associated with low back pain are not modifiable, such as gender and age, lifestyle behavior such as smoking, physical inactivity, flexibility, and muscular strength and endurance can all be improved. Because the origin of low back problems is often functional rather than structural, in many cases, the problem can be corrected through an exercise program that develops ***strength and flexibility*** in the appropriate muscle groups. Also, people who remain physically active throughout life retain more bone, ligament, and tendon strength; therefore, they are less prone to bone fractures and connective tissue tears.