Exercise

Definition

Exercise is physical activity that is planned, structured, and repetitive for the purpose of conditioning any part of the body. Exercise is used to improve health, maintain fitness and is important as a means of physical rehabilitation.

Purpose

Exercise is useful in preventing or treating coronary heart disease, osteoporosis, weakness, diabetes, obesity, and depression. Range of motion is one aspect of exercise important for increasing or maintaining joint function. Strengthening exercises provide appropriate resistance to the muscles to increase endurance and strength. Cardiac rehabilitation exercises are developed and individualized to improve the cardiovascular system for prevention and rehabilitation of cardiac disorders and diseases. A well-balanced exercise program can improve general health, build endurance, and slow many of the effects of aging. The benefits of exercise not only improve physical health, but also enhance emotional well-being.

Studies have shown that a consistent, guided exercise program benefits almost everyone from Gulf War veterans coping with fatigue, distress, cognitive problems, and mental health functioning to patients awaiting heart transplants. Exercise in combination with a reduced-calorie diet is the safest and most effective method of weight loss. The United States Department of Agriculture (USDA) food pyramid, called MyPyramid, makes exercise as well as food recommendations to emphasize the interconnectedness between exercise, diet, and health.

Precautions

Before beginning any exercise program, an evaluation by a physician is recommended to rule out potential health risks. Once health and fitness level are determined and any physical restrictions identified, the individual's exercise program should begin under the supervision of a health care or other trained professional. This is particularly true when exercise is used as a form of rehabilitation. If symptoms of dizziness, nausea, excessive shortness of breath, or chest pain are present during exercise, the individual should stop the activity and inform a physician about these symptoms before resuming activity. Exercise equipment must be checked to determine if it can bear the weight of people of all sizes and shapes. Individuals must be instructed in the proper use of exercise equipment in order to prevent injury.

Description

Range of motion exercise

Range of motion exercise refers to activity aimed at improving movement of a specific joint. This motion is influenced by several structures: configuration of bone surfaces within the joint, joint capsule, ligaments, tendons, and muscles acting on the joint. There are three types of range of motion exercises: passive, active, and active assists. Passive range of motion is movement applied to a joint solely by another person or persons or a passive motion machine. When passive range of motion is applied, the joint of an individual receiving exercise is completely relaxed while the outside force moves the body part, such as a leg or arm, throughout the available range. Injury, surgery, or immobilization of a joint may affect the normal joint range of motion. Active range of motion is movement of a joint provided entirely by the individual performing the exercise. In this case, there is no outside force aiding in the movement. Active assist range of motion is described as a joint receiving partial assistance from an outside force. This range of motion may result from the majority of motion applied by an exerciser or by the

person or persons assisting the individual. It also may be a half-and-half effort on the joint from each source.

Strengthening exercise

Strengthening exercise increases muscle strength and mass, bone strength, and the body's metabolism. It can help attain and maintain proper weight and improve body image and self-esteem. A certain level of muscle strength is needed to perform daily activities such as walking, running, and climbing stairs. Strengthening exercises increase muscle strength by putting more strain on a muscle than it is normally accustomed to receiving. This increased load stimulates the growth of proteins inside each muscle cell that allow the muscle as a whole to contract. There is evidence indicating that strength training may be better than aerobic exercise alone for improving self-esteem and body image. Weight training allows one immediate feedback, through observation of progress in muscle growth and improved muscle tone. Strengthening exercise can take the form of isometric, isotonic and isokinetic strengthening.

Isometric exercise

During isometric exercises, muscles contract. However, there is no motion in the affected joints. The muscle fibers maintain a constant length throughout the entire contraction. The exercises usually are performed against an immovable surface or object such as pressing one's hand against a wall. The muscles of the arm are contracting but the wall is not reacting or moving in response to the physical effort. Isometric training is effective for developing total strength of a particular muscle or group of muscles. It often is used for rehabilitation since the exact area of muscle weakness can be isolated and strengthening can be administered at the proper joint angle. This kind of training can provide a relatively quick and convenient method for overloading and strengthening muscles without any special equipment and with little chance of injury.

Isotonic exercise

Isotonic exercise differs from isometric exercise in that there is movement of a joint during the muscle contraction. A classic example of an isotonic exercise is weight training with dumbbells and barbells. As the weight is lifted throughout the range of motion, the muscle shortens and lengthens. Calisthenics are also an example of isotonic exercise. These would include chin-ups, push-ups, and sit-ups, all of which use body weight as the resistance force.

Isokinetic exercise

Isokinetic exercise utilizes machines that control the speed of contraction within the range of motion. Isokinetic exercise attempts to combine the best features of both isometrics and weight training. It provides muscular overload at a constant preset speed while a muscle mobilizes its force through the full range of motion. For example, an isokinetic stationary bicycle set at 90 revolutions per minute means that no matter how hard and fast the exerciser works, the isokinetic properties of the bicycle will allow the exerciser to pedal only as fast as 90 revolutions per minute. Machines known as Cybex and Biodex provide isokinetic results; they generally are used by physical therapists.

Cardiac rehabilitation

Exercise can be very helpful in prevention and rehabilitation of cardiac disorders and disease. With an exercise program designed at a level considered safe for the individual, people with symptoms of heart failure can substantially improve their fitness levels. The greatest benefit occurs as muscles improve the efficiency of their oxygen use, which reduces the need for the

heart to pump as much blood. While such exercise does not necessarily improve the condition of the heart itself, the increased fitness level reduces the total workload of the heart. The related increase in endurance also should translate into a generally more active lifestyle. Endurance or aerobic routines, such as running, brisk walking, cycling, or swimming, increase the strength and efficiency of the muscles of the heart.

Preparation

A physical examination by a physician is important to determine if strenuous exercise is appropriate or detrimental for an individual, especially when the exercise program is designed for rehabilitation. Before exercising, proper stretching is important to prevent the possibility of soft tissue injury resulting from tight muscles, tendons, ligaments, and other joint-related structures.

Aftercare

Proper cool down after exercise is important in reducing the occurrence of painful muscle spasms. Proper cool down stretching also may decrease frequency and intensity of muscle stiffness the day following any exercise program.

Risks

Improper warm up can lead to muscle strains. Overexertion without enough time between exercise sessions to recuperate also can lead to muscle strains, resulting in inactivity due to pain. Stress fractures also are a possibility if activities are strenuous over long periods without proper rest. Although exercise is safe for the majority of children and adults, there is still a need for further studies to identify potential risks.

Normal results

Significant health benefits are obtained by including a moderate amount of physical exercise in the form of an exercise prescription. This is much like a drug prescription in that it also helps enhance the health of those who take it in the proper dosage. Physical activity plays a positive role in preventing disease and improving overall health status. People of all ages, both male and female, benefit from regular physical activity. Regular exercise also provides significant psychological benefits and improves quality of life.

Abnormal results

Exercise burnout may occur if an exercise program is not varied and adequate rest periods are not taken between exercise sessions. Muscle, joint, and cardiac disorders have been noted among people who exercise. However, they often have had preexisting or underlying illnesses.

Key Terms

Aerobic

Exercise training that is geared to provide a sufficient cardiovascular overload to stimulate increases in cardiac output.

Calisthenics

Exercise involving free movement without the aid of equipment.

Endurance

The time limit of a person's ability to maintain either a specific force or power involving muscular contractions.

Osteoporosis

A disorder characterized by loss of calcium in the bone, leading to thinning of the bones. It occurs frequently in postmenopausal women.

For Your Information

Resources

Websites

- "Exercise and Physical Fitness." *MedlinePlus*. February 25, 2009 [cited February 26, 2009]. *http://www.nlm.nih.gov/medlineplus/exerciseandphysicalfitness.html*.
- "Exercise for Children." *MedlinePlus.* February 23, 2009 [cited February 26, 2009]. http://www.nlm.nih.gov/medlineplus/exerciseforchildren.html.
- "Exercise for Seniors." *MedlinePlus.* February 18, 2009 [cited February 26, 2009]. http://www.nlm.nih.gov/medlineplus/exerciseforseniors.html.

Organizations

- American College of Sports Medicine. P. O. Box 1440, Indianapolis, IN 46206-1440.
 Telephone: (317) 637-9200. Fax: (317) 634-7817. http://www.acsm.org.
- American Medical Association. 515 N. State Street, Chicago, IL 60610. (800) 621-8335.
 http://www.ama-assn.org.
- American Physical Therapy Association. 1111 North Fairfax Street, Alexandria, VA 22314-1488. (800) 999-APTA (2782) or (703) 684-APTA (2782). TDD: (703) 683-6748. http://www.apta.org.
- National Athletic Trainers' Association. 2952 Stemmons Freeway, Dallas, TX 75247-6916. (800) 879-6282 or (214) 637-6282. Fax: (214) 637-2206. http://www.nata.org.

Range of motion

Exercise therapy

Strengthening exercises

Cardiac rehabilitation

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exercise /ex·er·cise/ (ek´ser-sīz) performance of physical exertion for improvement of health or correction of physical deformity.

active exercise motion imparted to a part by voluntary contraction and relaxation of its controlling muscles.

aerobic exercise that designed to increase oxygen consumption and improve functioning of the cardiovascular and respiratory systems.

endurance exercise one that involves the use of several large groups of muscles and is thus dependent on the delivery of oxygen to the muscles by the cardiovascular system.

isokinetic exercise dynamic muscle activity performed at a constant angular velocity; torque and tension remain constant while muscles shorten or lengthen.

isometric exercise active exercise performed against stable resistance, without change in the length of the muscle.

isotonic exercise active exercise without appreciable change in the force of muscular contraction, with shortening of the muscle.

Kegel exercises exercises performed to strengthen the pubococcygeal muscle.

passive exercise motion imparted to a part by another person or outside force, or produced by voluntary effort of another segment of the patient's own body.

range of motion exercise the putting of a joint through its full range of normal movements, either actively or passively.

resistance exercise, **resistive exercise** that performed by the patient against resistance, as from a weight.

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ex-er-cise (ek ser-s1z)

n

Active bodily exertion performed to develop or maintain fitness.

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exercise

[ek'sərsiz]

Etymology: L, exercere, to exercise

- **1** *n*, the performance of any physical activity for the purpose of conditioning the body, improving health, or maintaining fitness or as a means of therapy for correcting a deformity or restoring the organs and body functions to a state of health.
- **2** *n*, any action, skill, or maneuver that causes muscle exertion and is performed repeatedly to develop or strengthen the body or any of its parts.
- 3 v, to use a muscle or part of the body in a repetitive way to maintain or develop its strength. Exercise has a beneficial effect on each of the body systems, although in excess it can lead to the breakdown of tissue and cause injury. Kinds of exercise are active assisted exercise, active exercise, active resistance exercise, aerobic exercise, anaerobic exercise, isometric exercise, isotonic exercise, muscle-setting exercise, passive exercise, progressive resistance exercise, range of motion exercise, therapeutic exercise, and underwater exercise.

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exercise [ek´ser-sīz]

performance of physical exertion for improvement of health or correction of physical deformity.

active exercise motion imparted to a part by voluntary contraction and relaxation of its controlling muscles.

active assistive exercise voluntary contraction of muscles controlling a part, assisted by a therapist or by some other means.

aerobic exercise a type of physical activity that increases the heart rate and promotes increased use of oxygen in order to improve the overall body condition.

ballistic stretching e's rapid, jerky movements employed in exercises to stretch muscles and connective tissue.

Buerger-Allen e's see **BUERGER-ALLEN EXERCISES**.

cardiovascular exercise exercises to promote improved capacity of the cardiovascular system. They must be administered at least twice weekly, with most programs conducted three to five or more times weekly. The contraction of major muscle groups must be repeated often enough to elevate the heart rate to a target level determined during testing. Used in the treatment of compromised cardiovascular systems, as in cardiac rehabilitation, or as a preventive measure.

corrective exercise therapeutic exercise.

endurance exercise any exercise that involves the use of several large groups of muscles and is thus dependent on the delivery of oxygen to the muscles by the cardiovascular system; used in both physical fitness programs and testing of cardiovascular and pulmonary function.

isokinetic exercise dynamic muscle activity performed at a constant angular velocity.

isometric exercise active exercise performed against stable resistance, without change in the length of the muscle.

isotonic exercise active exercise without appreciable change in the force of muscular contraction, with shortening of the muscle.

Kegel e's see KEGEL EXERCISES.

McKenzie exercise an exercise regimen used in the treatment of low back pain and sciatica, prescribed according to findings during mechanical examination of the lumbar spine and using a combination of lumbar motions, including flexion, rotation, side gliding, and extension. It is sometimes referred to as *McKenzie extension exercises*, but this is a misnomer because the regimen involves movements other than extension.

muscle-setting exercise voluntary contraction and relaxation of skeletal muscles without changing the muscle length or moving the associated part of the body. Called also <u>static</u> <u>exercise</u>.

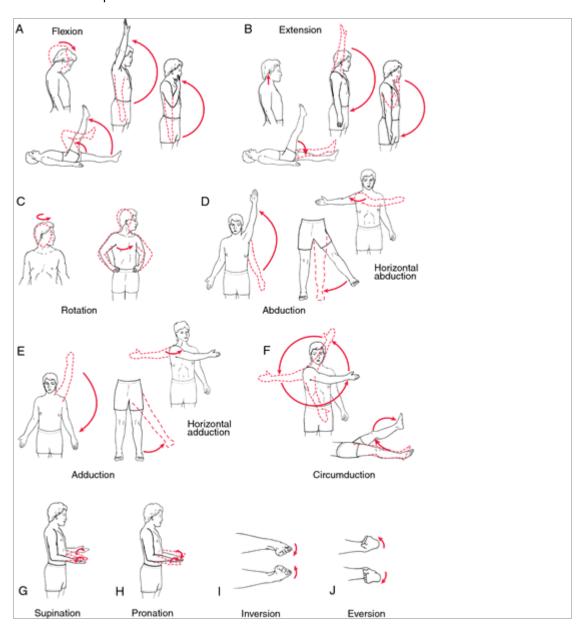
passive exercise motion imparted to a segment of the body by another individual, machine, or other outside force, or produced by voluntary effort of another segment of the patient's own body.

pelvic floor e's

- **1.** a combination of endurance and strength exercises of the pelvic floor (circumvaginal or perianal) muscles, used in the management of stress urinary incontinence; the patient is taught to isolate and contract muscles once or twice a day.
- **2.** in the NURSING INTERVENTIONS CLASSIFICATION, a <u>nursing INTERVENTION</u> defined as pelvic muscle exercise strengthening and training of the levator ani and urogenital muscles through voluntary, repetitive contraction to decrease <u>stress</u>, <u>urge</u>, or mixed types of urinary INCONTINENCE.

quadriceps setting exercise an isometric exercise to strengthen muscles needed for ambulation. The patient is instructed to contract the quadriceps muscle while at the same time elevating the heel and pushing the knee toward the mat.

range of motion (ROM) e's exercises that move each joint through its full <u>RANGE OF MOTION</u>, that is, to the highest degree of motion of which each joint normally is capable; they may be either active or passive.



Examples of range of motion exercises. *A*, Flexion: The bending of a joint. *B*, Extension: A movement opposite to flexion in which a joint is in a straight position. *C*, Rotation: Pivoting a body part around its axis, as in shaking the head. *D*, Abduction: A movement of a limb away from the median plane of the body; the fingers are abducted by spreading them apart. *E*, Adduction: Moving toward the midline of the body or to the central axis of a limb. *F*, Circumduction: A combination of movements that cause a body part to move in a circular fashion. *G*, Supination: Extension of the forearm to bring the palm of the hand upward. *H*, Pronation: Movement of the forearm in the extended position that brings the palm of the hand to a downward position. *I*, Inversion: Movement of the ankle to turn the sole of the foot medially. *J*, Eversion: Movement of the sole of the foot laterally. From Lammon et al., 1995.

See accompanying figure.

resistance e's (**resistive e's**) activities designed to increase muscle strength, performed against an opposing force; the resistance may be either isometric, isotonic, or isokinetic.

static exercise muscle-setting exercise.

static stretching e's the placement of muscles and connective tissues at their greatest length by steady force in the direction of lengthening. Short duration forces can be obtained manually, but special traction devices, splints, and casts are generally used to apply low-intensity forces for prolonged periods (30 minutes or longer). Warming the soft tissue before or during stretching will generally facilitate lengthening.

exercise stress tests tests used in EXERCISE TESTING.

exercise testing a technique for evaluating circulatory response to physical stress; it involves continuous electrocardiographic monitoring during physical exercise, the objective being to increase the intensity of physical exertion until a target heart rate is reached or signs and symptoms of cardiac ischemia appear. Called also stress testing. *f*

Clinical exercise testing has become an important tool in screening for and diagnosing early ischemic heart disease that cannot be detected by a standard resting EKG, and in predicting the probability of the development of the condition in later years. The technique cannot determine the location of the lesion causing cardiac ischemia and therefore must be supplemented with angiocardiography when coronary occlusion is detected.

Common forms of exercise used include the treadmill and the bicycle <u>ERGOMETER</u>. These procedures must be performed in a clinical setting where health care personnel are available in the event symptoms develop during exercise, such as dyspnea, vertigo, extreme fatigue, severe arrhythmias, or other abnormal EKG readings.

Exercise testing also may be used to assess the pulmonary status of a patient with a respiratory disease. As the patient performs specific exercises, blood samples are drawn for BLOOD GAS ANALYSIS, and ventilatory function tests such as tidal volume, total lung capacity, and vital capacity are conducted.

therapeutic exercise the scientific use of bodily movement to restore normal function in diseased or injured tissues or to maintain a state of well-being; called also <u>corrective exercise</u>. As with any type of therapy, a therapeutic exercise program is designed to correct specific disabilities of the individual patient. The program is evaluated periodically and modified as indicated by the patient's progress and response to the prescribed regimen. Exercises affect the body locally and systemically and bring about changes in the nervous, circulatory, and endocrine systems as well as the musculoskeletal system. *f*

Among the types of therapeutic exercise are those that (1) increase or maintain mobility of the joints and surrounding soft tissues, (2) develop coordination through control of individual muscles, (3) increase muscular strength and endurance, and (4) promote relaxation and relief of tension.

JOINT MOBILITY. In the absence of a disability that prohibits mobility, the regular day-to-day activities of living maintain the normal movements of the joints. If, however, motion is restricted for any reason, the soft tissues become dense and hard and adaptive shortening

of the connective tissues takes place. These changes begin to develop within four days after a joint has been immobilized and are evident even in a normal joint that has been rendered immobile. It is for this reason that therapeutic exercises to prevent loss of joint motion are so important and should be begun as soon as possible after an injury has occurred or a disease process has begun. *f*

Prevention of the loss of joint motion is much less costly and time-consuming than correction of tissue changes that seriously impair joint mobility. It is recommended that each joint should be put through its full range of motion three times at least twice daily. If the patient is not able to carry out these exercises, he is assisted by a therapist or member of the family who has been instructed in the exercises. Inflammation of the joint, as in arthritis, may cause some pain on motion, and so passive exercises are done slowly and gently with the joint as relaxed as possible. Procedures that stretch tight muscles to increase joint motion should be done only by a skilled therapist who understands the hazards of fracture and bleeding within the joint, which can occur if the exercises are done improperly or too strenuously.

MUSCLE TRAINING. Exercises of this type are taught to the patient who has lost some control over a major skeletal muscle. By learning precise and conscious control over a specific muscle, the patient is able to strengthen and coordinate its movement with normal motor patterns and thus enhance mobility. Muscle training or neuromuscular re-education demands full cooperation of the patient, who must be capable of understanding the purpose of the exercises, following directions, and giving full attention to the muscle isolated for retraining. The sessions are held in a quiet, comfortable atmosphere to facilitate concentration by the patient. *f*

The development of conscious control over individual muscles is useful in the rehabilitation of patients with a variety of disorders, including physical trauma, diseases such as poliomyelitis that affect the motor neurons, and congenital disorders such as cerebral palsy. It involves a systematic program of sequential activities under the direction of a therapist knowledgeable in the technique. Although it requires much effort on the part of the patient and the therapist, the attainment of muscle control and coordination is a satisfying reward.

MUSCLE STRENGTH AND ENDURANCE. Improvement of muscle strength and endurance is particularly important in the rehabilitation of patients whose goal is to return to an active and productive life after a debilitating illness or disabling injury. The exercises are prescribed according to the individual needs of the patient and usually involve more than one group of muscles. *f*

Strengthening (force increasing) exercises are prescribed after an examination has shown weakness in individual muscles or muscle groups. These exercises are usually administered with relatively high resistance and few (3 to 10) repetitions. A group of exercises, called a set, is followed by a few minutes of rest. Three to 5 sets for a muscle or group constitute one bout of exercises. Strengthening exercises are often performed daily in early stages of rehabilitation, but less often later in treatment.

Endurance exercises stimulate changes in the involved muscle or muscles, resulting in improved capacity for repeated contraction (e.g., increased ability to use metabolites). When conducted over a sufficient length of time and with several muscle groups, they may also produce central effects of the cardiovascular system (see cardiovascular exercise). Endurance exercises employ relatively low resistance and numerous (15 or more) repetitions. Endurance exercises are generally administered daily.

RELIEF OF TENSION. Exercises that promote relaxation of the muscles and provide relief from the effects of tension are useful in a wide variety of disorders ranging from mild

tension headache to insomnia. Patients who are especially tense may require several sessions of instruction in relaxation before they can learn the technique.

Williams' e's (Williams' flexion e's) a therapeutic exercise regimen used in the treatment of low back pain; it seeks to reduce lumbar lordosis through flexion of the lumbar spine and strengthening of the abdominal musculature.

Miller-Keane Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health, Seventh Edition. © 2003 by Saunders, an imprint of Elsevier, Inc. All rights reserved.

exercise,

n the performance of physical activity for the purpose of conditioning the body, improving health, or maintaining fitness or as a means of therapy for correcting a deformity or restoring the organs and bodily function to a state of health.

n See therapy, myofunctional.

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exercise

performance of physical exertion to obtain food or to achieve normal functions such as reproduction, for pleasure and for improvement of health or correction of physical deformity.

active exercise

motion imparted to a part by voluntary contraction and relaxation of its controlling muscles.

exercise conditioning

repeated exercise to condition an animal for a better performance at another time depends on an improvement in cardiovascular responses, splenic contraction and muscle, ligament and tendon responses.

corrective exercise

therapeutic exercise.

exercise fatigue

poor exercise tolerance.

exercise intolerance

manifested by a disinclination to move quickly in the absence of any apparent physical lameness or incoordination and respiratory distress on exercise.

passive exercise

motion imparted to a segment of the body by a therapist, machine or other outside force.

exercise physiology

includes the integrated physiological responses to exercise plus physical conditioning by training.

exercise testing

a technique for evaluating circulatory response to physical stress; called also stress testing. The procedure involves continuous electrocardiographic monitoring during physical exercise, the objective being to increase the intensity of physical exertion until a target heart rate is reached or signs of cardiac ischemia appear.

therapeutic exercise

the scientific use of bodily movement to restore normal function in diseased or injured tissues or to maintain a state of well-being. Called also corrective exercise.

exercise tolerance

one of the ways to measure cardiac and circulatory system efficiency is to measure the response of the cardiac and respiratory systems to graded exercise. In most animals such tests must be subjective because no data are available on normal responses. In horses tests are available for assessment of cardiopulmonary disease and as a measure of fitness.

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exercise

Public health The rhythmic contraction of muscles against a force Pros ↓ risk of cholecystectomy, ↓ risk of CAD, CHD, CA–colorectal, breast, prostate, DM–improved insulin utilization, obesity, stroke, osteoporosis, stress, anxiety; ↑ sexual pleasure, strength, flexibility, stamina, psychological well-being, general health; improved reaction time, memory, moods, immune resistance, sleep, self-confidence, control of arthritis, weight, quality of life. See Aerobic exercise, Anaerobic exercise, Breathing exercise, Cardiovascular exercise, Codman's pendulum exercise, Hoshino exercise, Isometric exercise, Isotonic exercise, Pritikin exercise, Vigorous exercise.

Exercise

Muscle

- **Isometric** Exercise against an unmoving resistance; isometric exercises consist of muscle contraction with a minimum of other body movements; isometric exercises build muscle strength and include weight-lifting or squeezing a tennis ball
- **Isotonic** Dynamic exercise Isotonic exercise consists of continuous and sustained movement of the arms and legs; isotonic exercises are beneficial to the cardiorespiratory systems and include running and bicycling

Whole body

- Low-impact aerobics Any type of aerobic exercise that promotes physical fitness, but does not stress musculoskeletal tissues, and joints; low-impact aerobic exercises include walking, swimming, bicycling
- **High-impact aerobics** Any type of aerobic exercise that promotes physical fitness, at the risk of stress to musculoskeletal tissues, and joints; high-impact aerobic exercises include aerobic dancing, basketball, running, volleyball

Exercise-kcal consumed/hour

Distance running (15 km/hour) 1000

Contact sports (wrestling, karate) 900

Bicycling (25 km/hour) 800

Swimming, freestyle 800

Basketball, volleyball 700

Jogging (9 km/hour) 600

Tennis 500

Coitus 450

Walking 400