

# Exercise Therapy

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## Aerobic Exercises

### Definition:

American College of Sports Medicine (ACSM): Aerobic exercise is any activity that uses large muscle groups, can be maintained continuously, and is rhythmic in nature.

World Health Organization (WHO): Activity in which the body's large muscles move in a rhythmic manner for a sustained period of time. Aerobic activity—also called endurance activity—improves cardiorespiratory fitness.

### PHYSIOLOGICAL RESPONSE TO AEROBIC EXERCISE:

1. Exercise stimulates sensory nerve fibers in skeletal muscles, activating the sympathetic nervous system (SNS).
  - a. SNS activation causes:
    - i. Increased heart rate
    - ii. Increased myocardial contractility (stronger heart contractions)
    - iii. Increased systolic blood pressure
    - iv. Vasoconstriction in nonworking tissues
    - v. These changes increase and redistribute cardiac output to active muscles.
2. Cardiac Effects
  - a. Heart rate increases due to:
  - b. Reduced vagal (parasympathetic) activity
  - c. Increased sympathetic stimulation
  - d. Myocardial contractility increases, leading to stronger heart contractions and greater stroke volume.
3. Peripheral Effects
  - a. Reduction in Total Peripheral Resistance
  - b. Blood vessels in inactive organs and muscles constrict.
  - c. Blood flow is redirected to active muscles.
  - d. Local metabolites ( $Mg^{2+}$ ,  $Ca^{2+}$ , ADP,  $CO_2$ ) cause vasodilation in working muscles.
  - e. Veins remain constricted, helping return blood to the heart.
4. Increased Cardiac Output
  - a. Caused by:
  - b. Increased heart rate
  - c. Increased stroke volume
  - d. Increased blood flow to active muscles
  - e. Increased venous return
  - f. Increased Systolic Blood Pressure
5. Respiratory Response to Exercise
  - a. Breathing increases rapidly, often before exercise begins.
  - b. Exercise increases oxygen demand and carbon dioxide production.
  - c. Factors stimulating respiration include:
  - d. Increased  $CO_2$  and  $H^+$  levels
  - e. Increased body temperature
  - f. Increased epinephrine

- g. Joint and muscle receptor stimulation
- 6. Ventilatory Changes
  - a. Respiratory rate and tidal volume increase.
  - b. Minute ventilation rises significantly.
  - c. Alveolar ventilation can increase 10–20 times during heavy exercise.
  - d. A steady state is usually reached within 3–4 minutes if exercise intensity remains constant.

Ref: Kisner C, Colby LA, Borstad J. *Therapeutic Exercise: Foundations and Techniques*. 5th ed. Philadelphia: F.A. Davis; 2018

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