Human Exercise Chapter

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Experiments

Basic Level Difficulty Rating:

HE-2: Recovery from Exercise

Advanced Level Difficulty Rating:

HE-1: Metabolic and Thermal Response to Exercise

HE-3: Exercise, Blood Pressure and Oxygen Saturation Levels

Exercise Physiology using Gas Analysis

HE-4: Respiratory Exchange Ratio

HE-5: Resting Metabolic Rate (RMR)

HE-9: Resting, Active and Exercising Metabolic Rates

HE-10: Aerobic Fitness

Overview

During activity in muscles and organs, the demand for oxygen by these parts of the body increases along with the need to move carbon dioxide away from these organs.The amount of oxygen delivered to the tissues in a unit period of time is affected by the physical fitness of the subject. More fit subjects can deliver more oxygen in a single cardiac cycle than less fit subjects, and they can also sustain a greater work level before reaching maximum heart rate. Less fit subjects of the same age and gender are usually unable to sustain the same level of work. Less fit subjects can reach about the same maximum heart rate, but they do so in a shorter period of time.

To study the metabolic and thermal responses of subjects to exercise. Monitoring the changes in the heart rate, core temperature, skin temperature, and active sweat gland density of a subject, along with the determination of the amount of work performed during exercise can help determine the subject's expenditure of energy, mechanical efficiency, heat storage, and evaporative heat loss

The energy cost of exercising increases in proportion to the work performed, until a maximum level of oxygen consumption is reached. Maximum oxygen consumption ($VO_{2\ max}$) is a plateau which is defined by the limits of the oxygen transport system, which include: pulmonary ventilation, the circulatory system, tissue/blood gas exchange, and cellular respiration. The principal factors that determine $VO_{2\ max}$ are genetically inherited or developed through endurance training. Humans can exercise above the $VO_{2\ max}$ workload, for short durations, because humans have a limited anaerobic capacity for energy production.

Only a minor portion of the energy produced during dynamic exercise is transform
maximum efficiency of utilizing energy for doing work is between 20 and 25%. Th
energy consumed during exercise is transformed to heat. Heat production is propor
rate and work; but, the additional heat load generated by exercise is affected by the balance of heat exchange between the body and the environment. If the transfer of heat to the environment is inefficient, the heat that can produce thermal stress on many systems, including the oxygen transport mechanism, builds up in the tissues and can cause damage to many of the body's systems..