Determinants of an Exercise Program

FITT- PRINCIPLE

- FITT method: *Frequency, Intensity, Time (duration), and Type of exercise*

Frequency

- There is no clear-cut information provided on the most effective frequency of exercise for adaptation to occur.
- Frequency may be a less important factor than intensity or duration in exercise training.
- Frequency varies, dependent on the health and age of the individual.

- **Optimal frequency of training is generally three to four times a week. If training is at a low-intensity, greater frequency may be beneficial**.
- A frequency of two times a week does not generally evoke cardiovascular changes, although older individuals may benefit from a program of that frequency.

Intensity

- based on the **overload principle and the specificity principle**

Overload Principle

- Overload is stress on an organism that is greater than that regularly encountered during everyday life
- To improve cardiovascular and muscular endurance, an overload must be applied to these systems

- The exercise load (overload) must be above the training stimulus threshold (the stimulus that elicits a training or conditioning response) for adaptation to occur.

- once adaptation to a given load has taken place, the training intensity (exercise load) must be increased for the individual to achieve further improvement.
- Training stimulus thresholds are variable, depending on the individual's level of health, level of activity, age, and gender.
- The higher the initial level of fitness, the greater the intensity of exercise needed to elicit a change

- A conditioning response occurs generally at 60% to 90% maximum heart rate (50% to 85% VO MAX
- depending on the individual and the initial level of fitness.

- Seventy percent maximum heart rate is a minimal-level stimulus for eliciting a conditioning response in healthy young individuals

- Sedentary or “deconditioned” individuals respond to a low exercise intensity, 40% to 50% of VO2 max

- The exercise does not have to be exhaustive to achieve a training response.
- Determining the *maximum heart rate and the exercise heart rate for training programs provides the basis for the initial intensity of the exercise*

- When the individual is young and healthy, the *maximum heart rate can be determined directly from a maximum performance multistage test, extrapolated from a heart rate achieved on a predetermined submaximum test or, less accurately, calculated as 220 minus age.*

Determine Maximum Heart Rate (HR)

- From multistage test (for young and healthy)
- HR achieved in predetermined submaximum test
- 220 minus age (less accurate)

Determine Exercise Heart Rate

- Percentage of maximum heart rate (dependent on level of fitness)
- Karvonen's formula (heart rate reserve)

Exercise heart rate = HR_{rest} + 60–70% (HR_{max} - HR_{rest})

Thank you

Time (Duration)

- The optimal duration of exercise for cardiovascular conditioning is dependent on the **total work performed, exercise intensity and frequency, and fitness level**.
- Generally speaking, **the greater the intensity of the exercise, the shorter the duration** needed for adaptation; and the lower the intensity of exercise, the longer the duration needed

- A **20- to 30-minute** session is generally optimal at **60% to 70%** maximum heart rate.
- When the intensity is below the heart rate threshold, a **45-minute** continuous exercise period may provide the appropriate overload.
- With high-intensity exercise, **10- to 15-minute** exercise periods are adequate

TYPE

- **specific aerobic activities**, such as cycling and running, the overload must use the muscles required by the activity and stress the cardiorespiratory system (specificity principle)
- If **endurance of the upper extremities** is needed to perform activities on the job, the upper extremity muscles must be targeted in the exercise program.

Reversibility Principle

- The beneficial effects of exercise training are transient and reversible.

- Detraining occurs rapidly when a person stops exercising.
- After only 2 weeks of detraining, significant reductions in work capacity can be measured, and improvements can be lost within several months.
- A similar phenomenon occurs with individuals who are confined to bed with illness or disability: the individual becomes severely deconditioned, with loss of the ability to carry out normal daily activities as a result of inactivity.

- The frequency or duration of physical activity required to maintain a certain level of aerobic fitness is **less than** that required to improve it

GENERAL RECOMMENDATIONS FOR AEROBIC PHYSICAL ACTIVITY:

- ***Children age 6 to 17:*** *60 minutes of moderate to vigorous aerobic physical activity per day.*
- ***Adults age 18 to 65****: 30 minutes of moderate intensity activity (3–6 MET level) 5 days/week or 20 minutes of vigorous intensity activity (>6 METs) 3 days/week, or a combination of moderate and vigorous intensity. The 30-minute total of moderate intensity can be accumulated in small bouts of continuous activity of at least 10 minutes.*
- **Older adults age 65 or older** (or adults 50 to 65 with chronic health conditions): 30 minutes of moderate intensity activity 5 days/week or 20 minutes of vigorous intensity activity 3 days/week, or a combination of moderate and vigorous intensity. The 30-minute total of moderate intensity can be accumulated in small bouts of continuous activity of at least 10 minute

Exercise Program

a warm-up period

the aerobic exercise period

a cool-down period.

Warm-Up Period

- **Physiological Responses**
- During this period there is:
- An increase in muscle temperature. The higher temperature increases the efficiency of muscular contraction by reducing muscle viscosity and increasing the rate of nerve conduction.
- An increased need for oxygen to meet the energy demands for the muscle. Extraction from hemoglobin is greater at higher muscle temperatures, facilitating the oxidative processes at work.
- Dilatation of the previously constricted capillaries with increases in the circulation, augmenting oxygen delivery to the active muscles and minimizing the oxygen deficit and the formation of lactic acid.
- Adaptation in sensitivity of the neural respiratory center to various exercise stimulants.
- An increase in venous return. This occurs as blood flow is shifted centrally from the periphery.

Purposes

- In addition to the physiological responses, the warm-up also prevents or decreases the susceptibility of the **musculoskeletal system to injury** and the occurrence of **ischemic electrocardiographic (ECG) changes** and arrhythmias.

Guidelines

- The warm-up should be gradual and sufficient to increase muscle and core temperature without causing fatigue or reducing energy stores. Characteristics of the period include:
- A **10-minute period of total body movement** exercises, such as walking slowly.

Aerobic Exercise Period

- four methods of training that challenge the aerobic system:
- continuous,
- interval (work relief),
- circuit,
- and circuit interval

Continuous Training

- A submaximum energy requirement, sustained throughout the training period, is imposed.
- Once the steady state is achieved, the muscle obtains energy by means of aerobic metabolism. Stress is placed primarily on the slow-twitch fibers.
- The activity can be prolonged for 20 to 60 minutes without exhausting the oxygen transport system.
- The work rate is increased progressively as training improvements are achieved. **Overload can be accomplished by increasing the exercise duration**.
- In the healthy individual, continuous training is the most effective way to improve endurance.

Interval Training

- With this type of training, the work or exercise is followed by a properly prescribed **relief or rest interval**. Interval training is perceived to be less demanding than continuous training. In the healthy individual, interval training tends to improve strength and power more than endurance.
- The relief interval is either a rest relief (passive recovery) or a work relief (active recovery), and its duration ranges from **a few seconds to several minutes**. Work recovery involves continuing the exercise but at a reduced level from the work period. During the relief period, a portion of the muscular stores of ATP and the oxygen associated with myoglobin that were depleted during the work period are replenished by the aerobic system; an increase in VO2 max occurs.

- The longer the work interval, the more the aerobic system is stressed. With a short work interval, the duration of the rest interval is critical if the aerobic system is to be stressed (a **work/recovery ratio of 1:1 to 1:5** is appropriate). A rest interval equal to one and a half times the work interval allows the succeeding exercise interval to begin before recovery is complete and stresses the aerobic system. With a longer work interval, the duration of the rest is not as important.
- A significant amount of high-intensity work can be achieved with interval or intermittent work if there is appropriate spacing of the work-relief intervals. The total amount of work that can be completed with intermittent work is greater than the amount of work that can be completed with continuous training.

Circuit Training

- Circuit training employs a series of exercise activities. At the end of the last activity, the individual starts from the beginning and again moves through the series. The series of activities is repeated several times.
- Several exercise modes can be used involving large and small muscle groups and a mix of static or dynamic effort.
- Use of circuit training can improve strength and endurance by stressing both the aerobic and anaerobic systems.

Circuit-Interval Training

- Combining circuit and interval training is effective because of the interaction of aerobic and anaerobic production of ATP.
- In addition to the aerobic and anaerobic systems being stressed by the various activities, with the relief interval, there is a delay in the need for glycolysis and the production of lactic acid prior to the availability of oxygen supplying the ATP.

Cool-Down Period

- The cool-down period is similar to the warm-up period in that it should last **5 to 10 minutes and consist of total-body movements and static stretching**.
- **The purpose** of the cool-down period is to:
- Prevent pooling of the blood in the extremities by continuing to use the muscles to maintain venous return.
- Prevent fainting by increasing the return of blood to the heart and brain as cardiac output and venous return decreases.
- Enhance the recovery period with the oxidation of metabolic waste and replacement of the energy stores.
- Prevent myocardial ischemia, arrhythmias, or other cardiovascular complications.

Thank you