4 Overview of Physical Fitness

In this chapter you will learn:

- The definition of physical fitness.
- The benefits of being physically fit and its relation to military readiness.
- The FITT Principle.
- The Physical Fitness Pyramid.
- Fuel used during exercise.
- Exercise Sequence.
- Training and Detraining.

In the military, physical fitness is emphasized because of its role in military readiness and force health protection. Many jobs in the Navy require that personnel handle heavy equipment, adapt quickly to harsh environments, and are able to work in limited quarters. Training for these situations ensures that you are physically able to perform these tasks repeatedly, without fail, whenever the need arises. In short, this is the rationale for optimizing your physical fitness levels and the reason you are required to perform PRT tests every six months! (See OPNAV6110.1E at http://www.bupers.navy.mil/services under "New Navy PRT Program" for the PRT standards).

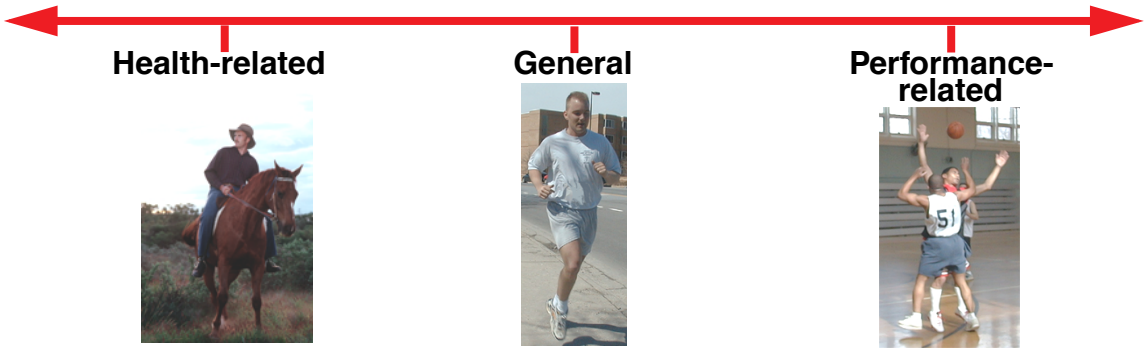
"Fitness, which has been defined as the matching of an individual to his physical and social environment, has two basic goals: health and performance [which lie on a continuum]. Physical fitness requirements in the military consist of a basic level of overall fitness required for health of all individuals and a higher level of fitness that is required for the performance of occupational activities...In addition to this, the military must address the need for ongoing, job-specific performance training."
IOM (1998) Physical Fitness Policies and Programs, in Assessing Readiness in Military Women, p. 64

What is Physical Fitness?

What does it mean to be physically fit? The American College of Sports Medicine (ACSM) has defined physical fitness as a set of characteristics (i.e., the work capacity of your heart and lungs, the strength and endurance of your muscles, and the flexibility of your joints) that relate to your ability to perform physical activities.

Regular physical activity leads to improved physical fitness and many other physiologic, cosmetic, and psychological benefits. Depending on personal goals and job requirements the level of physical fitness to attain can range from basic, health-related to more specific, performance-related fitness (Figure 4-1).

Figure 4-1. The Fitness Continuum



Lowers stress, increases metabolism, promotes health, prevents disease.

Increases muscle and heart and lung fitness, leads to a healthy body composition, improves flexibility. Most Navy personnel are in this category.

Enhances specific physical tasks or skills. For Navy personnel who perform physically demanding tasks. Also, for people competing in organized sports.

FITT Principle

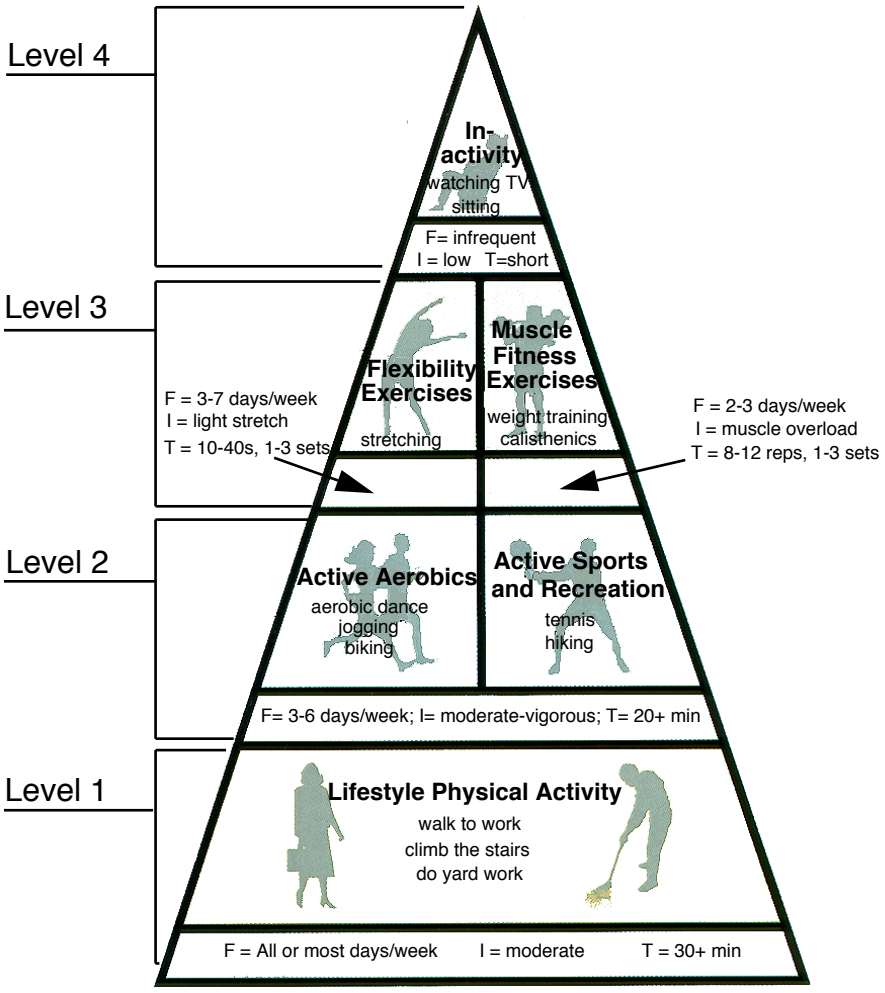
There are four basic components in all physical fitness programs. These are frequency of exercise, intensity of the exercise, time spent exercising, and the type of activity. Each factor is essential in planning your exercise routines and will influence the extent of your training results. Therefore, to optimize training time, recommendations have been set for the different types of training (i.e., cardiorespiratory (heart and lung) and muscle fitness). These are outlined in the Physical Activity Pyramid in Figure 4-2 and are called the **FITT Principle** guidelines.

FITT = Frequency, Intensity, Time & Type

The Physical Activity Pyramid

Just as the nutrition guidelines are outlined in the Food Guide Pyramid (Chapter 3), the guidelines for physical activity are diagrammed in the Physical Activity Pyramid (Figure 4-2). This pyramid was designed to help people live an active lifestyle, reap the fitness and performance benefits of routine exercise, reduce the health risks associated with inactivity, and reduce the injury risks associated with too much activity.

Figure 4-2. The Physical Activity Pyramid



F = frequency; I = intensity; T = time; exercise Type is in bold

Adapted from CB Corbin and RP Pangrazi. Physical Activity Pyramid Rebuffs Peak Experience. *ACSM's Health and Fitness Journal* 1998*;* 2(1): pages 12-17.

The four levels are arranged in the pyramid according to their FITT principle recommendations. Activities that should be performed most frequently are found at the base of the pyramid, and those that should be

performed less frequently are found at the top of the pyramid. Level 1 activities include household chores, walking to work, and walking up and down stairs. Level 2 activities include aerobic exercises and participation in sports and recreational activities, such as tennis, hiking, and biking. Level 3 consists of strength and flexibility exercises, while Level 4 includes sedentary activities, such as playing computer games and watching TV. It is recommended that you do some Level 1-3 activities each day to get the most health benefits.

Fuel Used During Exercise

Before discussing the various exercise guidelines in the following chapters, here is an overview of the energy systems used during exercise. Your body uses the macronutrients you eat (CHO, fats, and proteins) to make a chemical called **adenosine triphosphate (ATP)**. You need ATP to contract your muscles during exercise. ATP can be made two ways. One way makes ATP without using oxygen and is called the **anaerobic energy system.** The second way requires oxygen to make ATP and is called the **aerobic energy system**. Both of these systems (described below) are required during activity but, depending on the activity, there is a greater reliance on one system over the other.

Anaerobic Energy System

Activities that depend largely on this energy system last less than 5 minutes or have frequent rest periods. Examples include weight lifting, sprinting, and some interval training routines.

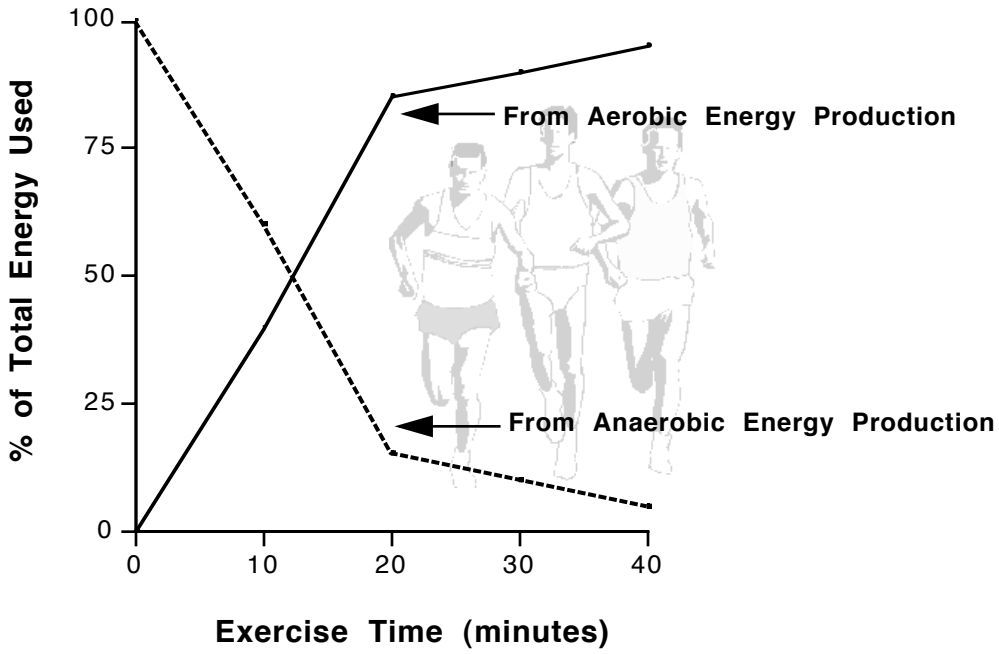
You may have heard about two of the chemicals involved in the production of ATP without oxygen: **creatine phosphate** and **lactic acid**. Creatine phosphate is present in the muscles and is used to make ATP rapidly. Creatine phosphate can make enough ATP to last for 30 seconds worth of exercise. To try and increase the amount of ATP that can be made from creatine phosphate, some people take creatine supplements. However, the research is not conclusive as to the benefits of taking creatine and the long-term risks are not known (see Chapter 14). Furthermore, your body makes creatine and it is obtained in the diet from meats. The second chemical is lactic acid. When maximal or near maximal exercise continues beyond 30 seconds, the muscle must use glucose (a simple CHO) to produce ATP. During this anaerobic energy process, the by-product lactic acid is formed. Small amounts of lactic acid can be converted back into glucose and then broken down again to form more ATP. However, as exercise continues, lactic acid begins to accumulate in the muscles and the blood, and you begin to fatigue. If maximal exercise is sustained, fatigue is inevitable within 3-5 minutes.

Aerobic Energy System

When moderate exercise continues beyond a couple of minutes, the aerobic energy system is activated to make ATP. Glucose and fats are used to make ATP in the presence of oxygen. The aerobic energy system, which produces much more ATP than the anaerobic energy system, is the primary system used during exercise lasting longer than five minutes; such as a 5K run, a 30 minute walk, or a 500 meter swim.

During most types of exercise, both the aerobic and anaerobic energy systems are involved. The amount of energy from each system depends on the duration and intensity of the exercise. Figure 4-3 illustrates the percentage of ATP each energy system contributes during exercise of various durations. As shown, when exercise duration increases there is a shift from greater use of anaerobic energy to aerobic energy.

Figure 4-3. Energy Use During Exercise

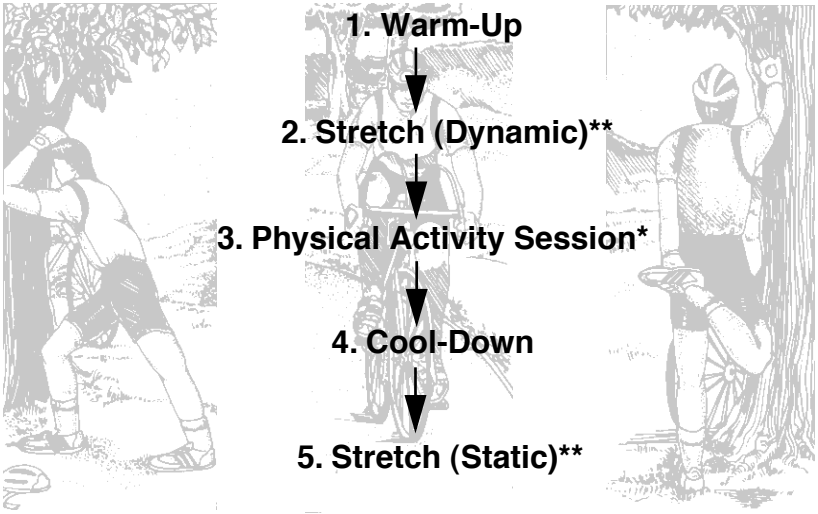


Powers S. (1993) Fundamentals of Exercise Metabolism. In Durstine JL et al (Eds). *ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription, 2nd ed.* (p.61) Baltimore: Lea & Febiger

Exercise Sequence

Regardless of your goals and training routines, there is an exercise sequence that should be followed to improve exercise performance and reduce the risk of injury. This sequence includes warming-up, stretching, and cooling-down, as outlined in Figure 4-4. The rationale for following this sequence is discussed next.

Figure 4-4. Recommended Exercise Sequence



*Refer to the exercises found in Levels 2 and 3 of the Physical Activity Pyramid.
**For more information on stretching see Chapter 9.

Warm-up

A warm-up prepares the body for physical activity by gradually increasing muscle temperature and metabolism, and increasing blood flow and oxygen delivery to the muscles. Warm-ups also protect connective tissue (the tendons that connect muscle to bone) and improve performance by lengthening short, tight (cold) muscles. Many individuals stretch in a misguided attempt to warm-up. However, because cold muscles are tight, there is a chance of injury when stretching without first warming-up. Start your warm-ups slowly (e.g., walk before running) and gradually increase the intensity. Warm-up for at least 5 minutes.

Always warm-up before stretching or exercising.

Cool-down

To avoid pooling of blood in the muscles and to remove metabolic end-products (i.e., lactic acid and carbon dioxide), exercise should end gradually. The cool-down, or recovery period, is very important because it will determine how you feel several hours after your workout. A cool-down should use the same muscles just exercised, and should be done at a light pace for at least 5 minutes after your main workout. This may help prevent muscle cramps, stiffness, and preserve performance during subsequent exercise.

Rest

Though some form of physical activity every day is strongly encouraged, rest is an exceedingly important factor in recovery from strenuous workouts.

Back-to-back high intensity workouts are not encouraged. Hard workout days should be followed by easy workout days or rest. This gives your body time to recover from the workouts. Days when you feel great should be your harder workout days. On days when it is an effort to put on your workout clothes, simply rest or perform a very light workout. The key is to make your workouts fun and challenging, and listen to your body.

Training and Detraining

Training and detraining are responsible for gains and losses, respectively, in fitness levels. Training according to the FITT Principle guidelines will lead to optimal fitness benefits. On the other hand, decreases in fitness due to detraining occur at twice the rate of training gains when physical activity stops completely. Table 4-1 lists some changes in fitness measures due to training and detraining.

Table 4-1. Training vs. Detraining

Training	Fitness Component	Detraining
↑	Heart and lung function	↓
↓	Resting heart rates	↑
↑	Muscle strength and endurance	↓
↑	Resting metabolism	↓
↑	Muscle fuel (glycogen) stores	↓
↑	Ability to sweat and dissipate body heat	↓

Detraining only takes 1 - 2 weeks! However, this can be minimized by maintaining your usual exercise intensity, even if the frequency and duration of workouts is decreased. This concept is important for Navy sailors to understand, as you may have limited time and fitness equipment available while deployed for extended periods. Ironically, it is in these situations that you depend most on your physical fitness to perform your duties. Therefore, learn the basic training principles and how to work around equipment, space, and time limitations (see Chapter 10).