State of California – Military Department
California Cadet Corps

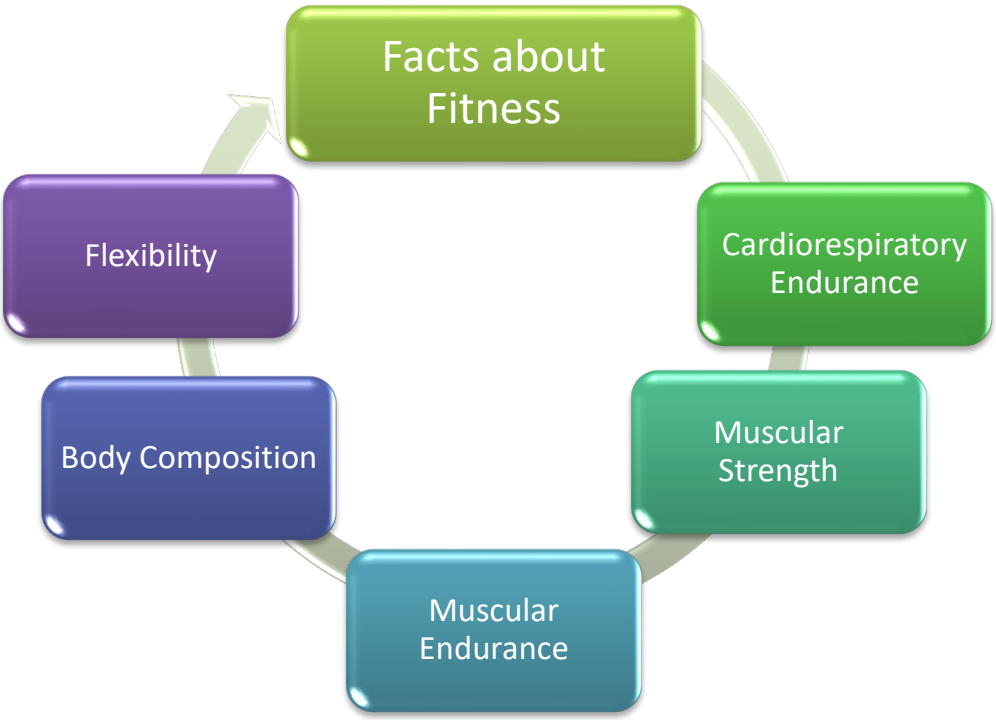
CURRICULUM ON Wellness: Facts about Fitness

Strand W3 Individual Fitness to You

Level 11

This Strand is composed of the following components:

A. Fitness and Testing
B. Physical Training
C. Facts about Fitness



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C. Facts About Fitness

STANDARD #4: Cadets participate in a variety of fitness and wellness activities.

OBJECTIVES

DESIRED OUTCOME (Self-Mastery)
The desired outcome of this unit is for students to learn various fitness facts in the five components of fitness, understand the human anatomy as it pretends to fitness, as well as the psychology involved in exercise and sports or as it relates to their life long health.

Plan of Action:

1. *Define cardiorespiratory endurance*
2. *Explain each of the three principles of physical activity*
3. *Give examples of each of the three patterns of moderate to vigorous Physical Activity*
4. *Identify what PRE stands for*
5. *Give examples of how PRE is used in isotonic exercises using the FITT formula*
6. *Define the Double Progressive System*
7. *Explain the difference between the FITT and the FIT Formula*
8. *Each step of executing PRE safely using weights*
9. *Explain muscle-bound and why and an individual should not practice it*
10. *Understand the history of Plyometrics*
11. *Define how Plyometrics is used now and other terms it is disguised by*
12. *Explain interval training*
13. *Understand and explain the myths of females fitness*
14. *Understand the Submaximal Endurance Capacity*
15. *Define the Central Nervous Systems' role in fatigue and how it can be challenges or combatted.*
16. *Identify all body composition measurement methods in order from most clinically accurate to the lest accurate*
17. *Calculate the density of the body using the equation*
18. *Define Body Composition*
19. *Define the two main types of eating disorders and signs/characteristics of each*
20. *Identify substance abuse*
21. *Define some characteristics of substance abuse*
22. *Define relative body fat*
23. *Understand the dehydration of the body*
24. *Explain chronic fatigue syndrome*
25. *Explain Body mass Index (BMI) chart, and how it is used specifically*
26. *Explain the three specific different health-related issues ONLY females have being underweight*
27. *Understand the anatomical structure of tendons vs ligaments*
28. *Define flexibility*
29. *Explain and execute a Static stretch, a PNF stretch, and a ballistic stretch.*
30. *Define hypermobility*

C1.Fitness Component: Cardio-Respiratory Endurance

Cardiorespiratory endurance is the combination of cardiovascular meaning heart, blood and blood vessels, with lungs, and oxygen from outside the body. A physically active person typically has more branching blood vessels on their heart, whereas a non-physical active person will have less, aiding to the supply of oxygen and blood as seen in **Figure 8.4(right).** The heart is a muscle that runs off **involuntary contractions** signals to contract without consciously telling it to do so. Building cardiorespiratory endurance is mostly completed through **aerobic activity** is a steady activity that supplies oxygen to the muscles from the heart. **Vigorous aerobics** is defined as activities that elevate heart rate above the threshold for the duration of exercise an effective way to increase cardiorespiratory. It is suggested that vigorous aerobic exercises to be done at least 3 days a week for at least 20 minutes a day. There are three principles of physical activity, one already discussed in the previous lesson **W3 B. Physical Training**, was the Principle of Specificity. The second one is the **Principle of Overload**, which decrees that the only way to create health and activity benefits is to require the body to do far more than it would normally do. The third is the **Principle of Progression**, which states to increase activities exercises intensity gradually and allow the body to adapt to the levels of exercise. Below in **Table 8.3**, it gives more specifics on types of exercises and frequency (Corbin & Le Masurier, 2014).

Figure 8.4 Blood vessels on the heart: *(a)* the heart of a typical person; *(b)* the heart of a person who exercises regularly.

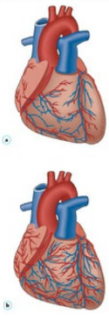


TABLE 8.3 Threshold of Training and Target Heart Rate Zones (FIT Formula) for People With Different Activity Levels

	Threshold of training			Target heart rate zone		
Current activity level	No regular vigorous activity	Some vigorous activity	Regular vigorous activity	No regular vigorous activity	Some vigorous activity	Regular vigorous activity
Frequency	3 days a week for all fitness levels			3–6 days a week for all fitness levels		
Intensity	Percentage			Percentage		
HRR* % max HR**	50 70	60 80	70 84	50–70 70–85	60–80 80–91	70–89 84–95
Time	20 min for all activity levels***			20–90 min for all activity levels***		

*HRR indicates heart rate reserve.
**% max HR indicates percent of maximal heart rate.
***Sessions of at least 10 minutes can be combined to meet time recommendations.
Based on ACSM exercise prescription guidelines.

FITT Formula is defined as Frequency, Intensity, Time and Type, in short meaning how often, how hard, how long, and what type of exercises. **Frequency** is how a task is performed. **Intensity** the vigorousness of a task or exercise. **Time** the length of the task or exercise. **Type** the specific kind of exercise or task

being performed. A model for teens utilizing the FITT Formula is shown in the Physical Activity Pyramid for teens show in **Figure 5.2** right (Corbin & Le Masurier, 2014).

Patterns of moderate activity and vigorous activity have three primary patterns. **Pattern one (daily)** is to be engaged in continuous activity per day, for example, a one 30 minute session. **Pattern two (Accumulated)** is to accumulate the activity time, in broken-down 10-minute sessions to hit your goal of total activity time, for example, 10 mins + 10mins +10mins throughout a daily schedule. It can accumulate more than 30 minutes if the individual target is a longer amount of time. **Pattern three (weekend warrior)** is deemed the "weekend warrior," meaning having a long duration of activity sessions sometimes for several hours in one day per week or weekend. Even though this is a pattern choice it is *not recommended* due to the increased risk factors and it violates the principle of progression, resulting in soreness and higher injury opportunity (Corbin & Le Masurier, 2014).

Check on Understanding:

1. What are the three principles of exercise?
2. Pattern three of moderate activity is highly recommended to do. (T/F)
3. The heart is a voluntary muscle. (T/F)

C2. Fitness Component: Muscular Strength

Muscles grow stronger through being built up, which can only be completed by building muscle fitness. **PRE** as it is commonly referred to, **Progressive Resistance Exercise** is the most basic routine to build up muscular strength. More specifically, the isotonic PRE (resistance machines and free weights) utilizing the FIT formula. This **FIT formula** focuses the exercise to Frequency how often, Intensity (% of 1RM) and the time, how many reps and sets that are completed. The **Double Progressive System** of PRE is increasing reps as the individual increases the sets, the second portion to create a double progression is to increase the resistance or weight of each focused exercise. There are scientific differences between free weights and resistance machines. For example, free weights build more balance, muscle coordination, they allow for relative movements equivalent to daily life. Similarities both build muscular strength and endurance. Below in **Table 10.8** of the Resistance Machines vs Free Weights shows direct differences per category (Corbin & Le Masurier, 2014).

TABLE 10.8 Resistance Machines Versus Free Weights

	Resistance machines	Free weights
Safety	Safer because weights cannot fall on lifter Spotter often not needed	Greater chance of injury from falling weights Easy to lose control of—spotter needed
Cost	Very expensive to own If not owned, club membership required to use	Relatively inexpensive
Versatility	Easy to isolate specific muscle groups	More balance, muscle coordination, and concentration required More muscles used, movements more like moving heavy loads in daily life
Convenience	Much floor space needed Must be used where installed	Little space needed Some weights small enough to carry around Easily scattered, lost, or stolen

Executing PRE correctly and safely is usually completed through using a routine. An example fo the routine is:

1. Warm-Up before every workout
2. Use Proper Exercise techniques
    a. Moderate speed for completing the movements
    b. Do a full range of motion (concentric and eccentric contractions)
    c. Avoid quick movement
    d. No holding your breath during exercise
    e. Always use good biomechanics(stay away from awkward body positions)
3. Make sure the area is safe
4. Use spotters with free weights
5. Progress gradually
6. Select major Muscle group exercises
7. Always remember to rest between sets
8. Allow for rest days
9. To keep engagement vary your exercises
10. Avoid overhead lifts with free weights
11. Master single-joint exercises
    a. Then progress to multiple-joint exercises
        i. Ex: a Clean or a Jerk
12. Be safe with the free weights and never use carelessly
13. Never compete using resistance training

Bodybuilding is where the participants are more focuses on the body/physique's appearance. Particularly being judged by the way the muscles are shaped, defines, and size having nothing to do with

the muscular strength. At times during the bodybuilding process, an athlete may become **muscle-bound** is having big bulky muscles that inhibit free movement or range of motion. This results in an issue such as inflexibility, inability to utilize the full capacity of muscular strength and instability of the joint. This happens when two things happen; only training on one side of the muscle joint, and not completing the full range of motion during exercise. Lifting is an exercise practice that makes up weight training workout courses. **Weightlifting** is an Olympic Sport that involves free weights being lifted at maximum load of each individual, in two categories, the Clean and the Jerk. **Powerlifting** is a competitive sport that involves free weights being lifted at maximum load of each individual, in three categories, the bench press, the squat, and the deadlift (Corbin & Le Masurier, 2014).

Building Muscle with Isometric PRE is about building power, which is the combination of strength and speed of the muscles. It is done by doing isometric exercises with a FIT approach. It is not considered to be as effective as isotonic PRE FIT. An example of isometric PRE is seen below in **Table 10.10** (Corbin & Le Masurier, 2014).

TABLE 10.9 Target Zone for Calisthenics (Isotonic)

	Threshold	Target zone
Frequency (days per week)	3	3–6
Intensity	Moving the weight of parts of the body	Moving the weight of parts or all of the body
Time	1 set of 10 reps	1–4 sets of 11–25 reps

Rest for 2 minutes between sets.

Plyometrics exercise, famously used by the Olympic Soviet Union Track and Field coaches in the 1980's is a type of exercise that is designed to enhance athletic abilities by jumping, hopping, and other exercises that cause a lengthening of muscles that then cause a shortening contraction of the muscles. These also have been called and interchanged with **agility exercises or drills**. Through using these exercises the body weight provides the resistance weight adding to the power of the muscles being worked out. Recent evidence has examined the use of Plyometrics and has found that it reduces athlete injuries, and increases both power and speed (Corbin & Le Masurier, 2014).

Interval training is bouts of high-intensity exercises that allow for small rest periods or breaks. This type of exercise is used largely in the swimming and running athletics. It is to increase the individual's anaerobic performance during the activities. It has been found useful and helpful in other sports such as soccer, hockey, football, and basketball, where the sport may demand more of quick energy usage of performance and mellow down.

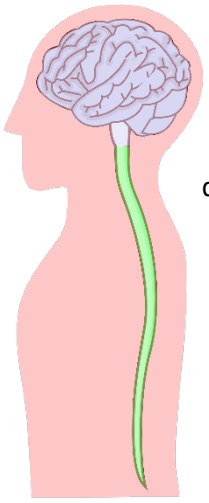
Muscle Fitness for females, typically fitness is universal between both genders on how and what to do for the individual. A myth is that if females utilize the isotonic or isometric PRE they will look manlier or masculine, this myth is 100% false. **Muscle toning** scientifically is considered a "quack word" because it does not refer to any type of measurable outcome (Corbin & Le Masurier, 2014).

Check on Understanding:

1. Define the FIT Formula as it relates to the PRE.
2. What is the difference between Weightlifting and Powerlifting?
3. Muscle bound is the same as Body Building (T/F)

C3. Fitness Component: Muscular Endurance

Being able to sustain specific muscular activity is needed in fitness courses and sports. **Muscular endurance** is the basic muscular ability to not fatigue or become tired. Muscular endurance is achieved through gains in muscular strength in conjunction with local metabolic and circulatory functions. **Submaximal endurance capacity** is the average of absolute output-power a person can maintain for a fixed amount of time, sometimes referred to in layman's terms as a **clinical stress test.** When a person reaches or consistently practices endurance exercises, the body adjusts levels of blood lactate concentration and pH balances. **Lactate** is the salt produced from **lactic acid** the product that allows the muscles to produce energy without oxygen in the moment of exercise, which is during an anaerobic function. It also is the body chemical that causes soreness after workouts if endurance is not already built up, or the intensity and repetition have been increased. It is not usually to blame for fatigue during aerobic exercise but science is not definitive. Muscular endurance also has a great deal with the role of the **CNS** system, **Central Nervous System**, the vital system of the human body that consists of the brain and spinal column. It plays a large part in what Kinesiologists and exercise scientists call **neuromuscular fatigue**, the exercise-induced inability or lack of ability of a muscle to apply force or produce power. Fatigue the sensation of tiredness that results in a lack or declined ability to produce a standard muscular performance. An interesting fact about fatigue is that the CNS is responsible for limiting exercise performances and enacting signals of fatigue, but it can be challenged and combatted by the athlete listening to music, or cheering crowds. It cues a different part of the brain to allow for the athlete to push further or through the fatigue they were beginning to feel (Willmore, Costill & Kenney, 2008).



Check on Understanding:

1. Explain the difference between submaximal endurance capacity and neuromuscular fatigue.
2. Neuromuscular fatigue is any ability to not produce power or apply force (T/F)
3. Explain what can override the CNS when an athlete starts to fatigue, why do you think it is possible?

C4.Fitness Component: Body Composition

Measuring Body composition is done with a variety of ways to measure, there are four main laboratory assessments used to capture the body composition, and two are the most executed. The first and considered the best method is **X-Ray Absorptiometry (DXA)** it is an X-Ray that can detect the difference between fat, bone, muscle, and tissue **Figure 15.3.**

FIGURE 15.3 The dual-energy X-ray absorptiometry (DEXA) machine used to estimate bone density and bone mineral content as well as total body composition (fat mass and fat-free mass): (*a*) the machine, (*b*) a regional scan of the body.

FIGURE 15.2 Hydrostatic weighing (the underwater weighing technique) to determine the density of the body.

Second, **Underwater weighing**, a procedure where the person is weighed on land, then weighed in a big water tank after expelling all air from the lung reserve for 10-15 seconds, and then weighed again, a math equation is applied to the results and the test gives the approximate underwater weight and lung capacity seen in **Figure 15.2** Underwater weighing is also known as **hydrostatic weighing**, and the math equation applied to calculate the body fat percentage for body composition completed through Density of the body= Mass of Body ÷ Body Volume, (D=M÷V) then you can calculate the body fat percentage through, % of body fat= (495 ÷ Body Density)- 450, (%BF=495÷D)-450 (Willmore, Costill & Kenney, 2008). The third is the **bod pod** in **Figure 15.4** which is an assessment done through a machine that looks like an egg capsule and the space the person being tested body moves the air out of the pod is how it calculates the body fat percentage. Lastly, there is the **skinfold test in Figure 15.5,** a widely accepted and applied way of measuring body composition, it measures the body's density of mass in a comparison of body fat and fat-free mass though using a caliper method at one or more sites. The simplest form of body fat percentage is done through a **bioelectric impedance**, a scale-like device that sends an electric current through the body back to the machine that gives the percentage of body fat by calculating the amount of resistance of the current through the tissue. This type of measuring tool is the least accurate and only gives a relative body fat measurement (Willmore, Costill & Kenney, 2008).

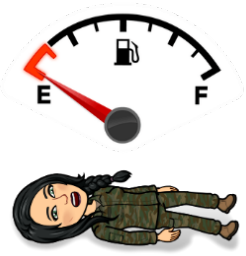
FIGURE 15.4 The Bod Pod air plethysmography device uses the air displacement technique to estimate total body volume.

FIGURE 15.5 Measuring skinfold fat thickness at the triceps skinfold site.

The psychology of body composition comes with many defined diagnoses and disorders. **Body dysmorphia** is when an individual becomes obsessed with building muscle. Some psychologists refer to it as "reverse anorexia." This particular issue usually needs to be treated by a professional psychologist, because it usually becomes a form of obsessive-compulsive disorder OCD. (Corbin & Le Masurier, 2014). **Anorexia Nervosa** is an eating disorder that includes three to four key characteristics, refusal to keep a healthy body weight by medical standards, afraid of gaining weight, disturbance in how one view's their weight or body, the fourth characteristic is for females only, the absence of three consecutive menstrual cycles. **Bulimia** is an eating disorder that can be any combination of five characteristics reoccurring binge eating, lack of control during binge eating, regular self-induced vomiting, an average of two binge-eating per week

for at least three months, over-concerned with one's body image or weight. **Substance abuse** is one term that may include anything from, performance-enhancing drugs (steroids), recreational drugs (street drugs, over the counters (OTC's) and pharmaceuticals) and alcohol. Signs of substance abuse are but not limited to; change in behavior, changes in peer-group, personality changes, mood swings, athletic performance changes, being apathetic, anxiety, coordination changes, grooming, and hygiene may fail, sweating profusely and muscle twitches (Weinberg & Gould, 2015). This type of abuse may be more prevalent in sports that need a certain body composition, weight range, or body image. These sports would be but not limited to, wrestling, swimming, diving, water polo, cheerleading, gymnastics, weight training, dance, ballet, and pole vault.

Weight standards are usually based on individual physiology and sport type. **Relative body fat** is the ratio of fat mass to total body mass, usually expressed as a percentage amount. For example, in the study from 1977, most distance runners are usually under 12% body fat and it was discovered the top long-distance runners in the same study were measured at 6% body fat. But the best United States distance runner was measured at 17% body fat and the women who held the best record time for the 50-mile run had 37% body fat. The relative portion is that the sport and the competitive level does not always predict the body fat percentage expectation. Weight is not the same as mass and is not the same as losing fat mass, weight can be lost through **dehydration** (loss of body fluids) techniques such as fasting, low-calorie diets, and lack of water consumption. Forcing the body to low weight can cause lifelong repercussions. **Chronic fatigue syndrome** appears to be an immune system dysfunction that causes extreme fatigue, muscle soreness, and cognition dysfunctions that lasts for months or year. Body composition health issues that may arise in a female that is underweight, by medical standards through the **Body Mass Index**, a weight and height chart that calculates body fat percentage as it correlates with body composition. The issues females can encounter if they are underweight are **oligomenorrhea** infrequent or really light menstrual flow, **amenorrhea** stopped the regular menstrual flow, and **delayed menarche** the absence or never starting their period. These health concerns can be caused by underweight, but also by caloric restriction, and some vegetarian diets (Willmore, Costill & Kenney, 2008).



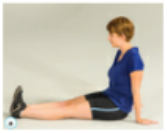
Check on Understanding:

1. Name 3 of the 5 methods to measure body composition for an individual.
2. Body Dysmorphia is only related to working out too much in men/males. (T/F)
3. Females are at no risk for health-related issues when they are underweight (T/F)

C5. Fitness Component: Flexibility

Flexibility is being able to complete a full range of motion, (ROM) of all joints to understand flexibility the anatomy of the body structure must be known. At each joint in the body, the joint has **ligaments** structured around it, which are non-elastic bands of connective tissue that connect bone to bone. **Tendons** are semi-elastic bands of connective tissue that connect muscle to bone. **Muscle-tendon unit (MTU)** is skeletal muscles and tendons that are attached to bones, they are called a unit because they work together. Flexibility one of the 5 components of fitness, sometimes known as the "forgotten part" of fitness. Maintaining flexibility is crucial to maintaining overall health and mobility. The older people become the more the flexibility begins to decrease, this is why ROM is so important to be able to complete and build towards full ROM. Flexibility is important as a lifelong skill but it plays a larger part in select sports, gymnastics, dance, swimming, and football kickers. It is seen as a good performance skill in tennis, baseball and golf for longer backswings, and faster forward swings. Flexibility can be improved through stretching; there are three types of stretches. **The static stretch** this can be completed as an active or passive type of stretch that is slow stretching as far as an individual can go without pain **Figure 12.3. Proprioceptive neuromuscular facilitation (PNF) stretch**, it is a combination of static stretching paired with contracting the muscle before stretching it, this method was widely used by a physical and occupational therapist for soldiers who had been injured, but is now used in a recreational manner. More specifically PNF stretching has another form called **CRAC, contract-relax-antagonist-contract**, which is exactly as it reads, contract eh muscle you want to stretch let it relax and then contract the antagonist muscle during that relaxation period. **Ballistic stretch** is a stretching method that involved bouncing and bobbing motions. Heredity plays its part in the ability skill of flexibility, **hypermobility** is the larger or past the full range of motion in certain joints also known as **double-jointed.** Females tend to be more flexible than males, twice as many females to males are more flexible (Corbin & Le Masurier, 2014).

Figure 12.3 Stretching the calf: *(a)* active stretch; *(b)* passive stretch (with a partner assisting).



Check on Understanding:

1. PNF Stretching is only used on soldiers who have been injured and not allowed to be used recreationally. (T/F)
2. This connective tissue connects Bone to muscle _____.
3. The name of the non-elastic band of connective tissue is _____.

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