UNITED STATES MARINE CORPS
THE BASIC SCHOOL
MARINE CORPS TRAINING COMMAND
CAMP BARRETT, VIRGINIA 22134-5019

COMBAT CONDITIONING CONCEPTS B1Y0105XQ STUDENT HANDOUT

Combat Conditioning Concepts

Introduction

The Marine Corps serves as the nation's expeditionary force in readiness. Combat conditioning in the Marine Corps is designed to prepare Marines to physically withstand the rigors of combat. All other goals of physical training must support the physical requirements of combat. This concept not only develops a more physically fit Marine, it also develops an individual who is mentally tough and confident.

Importance

Marine Corps Order 6100.13 states every Marine must be physically fit regardless of age, grade, or duty assignment. Combat conditioning emphasizes the requirement for all Marines to adopt a healthy lifestyle and a lifelong commitment to fitness. This combination has a direct and positive impact on job performance and combat readiness. The objective of the Combat Conditioning is to offer physical conditioning information that will assist with appropriate, well-designed fitness programs and workouts that, when implemented, will benefit the Marine.

In This Lesson

The purpose of this lesson is to teach you the concepts of combat conditioning.

This lesson covers the following topics:

Learning Objectives

Terminal Learning Objectives

TBS-COND-2101 Given Marines and individual field equipment, conduct combat conditioning to prepare for the rigors of combat.

Enabling Learning Objectives

TBS-COND-2101l Given individual field equipment and field expedient weight materials, apply performance training techniques to prepare for the rigors of combat.

TBS-COND-2101m Given individual field equipment and field expedient weight materials, perform functional fitness to prepare for the rigors of combat.

TBS-COND-2101n Given individual field equipment and field expedient weight materials, apply injury prevention techniques to prepare for the rigors of combat.

TBS-COND-2101o Given an evaluation, identify the elements of "Training for Performance" principles used to prepare for the rigors of combat.

TBS-COND-2101p Given an evaluation, identify the elements of a balanced workout, to prepare for the rigors of combat.

TBS-COND-2101q Given an evaluation, describe the elements of injury prevention used to aid Marines in reducing injuries caused by physical conditioning to prevent further combat conditioning injuries while preparing for the rigors of combat.

TBS-COND-2101r Given an evaluation, identify the key components of nutrition as they relate to combat conditioning.

Training for Performance

The training for performance section outlines the categories of preparation needed by Marines to ensure they are physically ready for combat duty. Included are the components of physical fitness, the FITT (Frequency, Intensity, Time, and Type) principle, principles for physical conditioning, and the unique characteristics of periodization training.

Components of Fitness. There are five components of physical fitness essential to maintain or improve health and wellness.

- **Body Composition:** Body composition is the ratio of lean body mass to body fat mass. Lean body mass includes the structural and functional elements in the body's cells, body water, muscle, bone, heart, liver, kidneys, and other organs. Fat mass consists of essential fat needed to protect the organs, and fat that is stored. Increased body composition, also known as obesity, can put a person at risk for heart disease, diabetes, hypertension, high cholesterol, and even some cancers. These risks are associated with physical inactivity, which is one of the reasons Marines are permitted and encouraged to participate in daily physical activity. Marines who do not meet the criteria of accepted Marine Corps height and weight standards will have their body composition tested to assure they meet the body composition percentage range for their age, as outlined in Table 1.

Table 1: Marine Corps Body Composition Standards

Marine Corps Body Composition Standards		
Age Group	**Male Maximum Body Fat**	**Female Maximum Body Fat**
17 – 26	18%	26%
27 – 39	19%	27%
40 – 45	20%	28%
46 and older	21%	29%

- **Cardiovascular Fitness:** Cardiovascular fitness refers to conditioning the heart and lungs. The efficiency in which the heart and lungs provide adequate amounts of oxygen to working muscles over long periods of time is improved with consistent physical activity. How does improved cardiovascular fitness benefit the body and thereby improve the combat readiness of a Marine?

  The heart becomes stronger with chronic exercise. It also improves the stroke volume of the heart, which is the amount of blood pumped by the left ventricle of the heart in one contraction. The lungs develop greater volume, and the diaphragm becomes stronger through conditioning. Additionally, the blood volume circulating through the body increases with exercise, producing greater hemoglobin content for red blood cells. With repeated conditioning, the vascular system creates more pathways, blood vessels become larger, and more capillary sites are created. Cardiovascular fitness can take two forms, aerobic and anaerobic.

Aerobic conditioning refers to those activities with long duration and lower intensity. While performing these types of activities, the target heart rate should be within the range of 70 to 80 percent of your maximum heart rate. To determine your maximum heart rate, subtract your age from 220. Some of the aerobic conditioning activities used to achieve this target heart rate include running, swimming, cycling, rowing and skiing. Aerobic conditioning activities have many health benefits for those who partake in them. Among the benefits are:

- Increased cardio-respiratory endurance
- Increased muscle strength – slow twitch and connective tissue
- Increased blood volume and stroke volume
- Larger storage capacity of muscle glycogen
- Increased capillary development and increased mitochondria
- Decreased resting heart rate
- Improved temperature regulation
- Decreased body fat

Anaerobic conditioning consists of high intensity, intermittent bouts of exercise. These activities place the target heart rate between 80 and 90 percent of one's maximum heart rate. Anaerobic conditioning activities include weight training, plyometrics, interval training, as well as speed and agility training. These activities also contribute greatly to improved health. Benefits include:

- Increased muscular strength
- Increased power
- Improved local muscular endurance
- Decreased body fat
- Improved flexibility
- Increased aerobic capacity
- Improved motor performance

Energy Systems: Exploring the energy systems that produce energy for working muscles within the body will further explain the benefits of cardiovascular conditioning. (See Table 2.) It is important to understand how these systems function and develop to optimize them successfully in a Marine. Every Marine has a dominant system, so some types of physical activity will be performed more easily based on each Marine's physical structure.

The ATP-PCR System: Adenosine Triphosphate (ATP) is the direct, concentrated source of energy stored in muscle cells, and can only fuel very quick and powerful movements. Phosphocreatine (PCr) breaks down and then rebuilds ATP, thus allowing the energy process to be repeated. Oxygen is not required for this to occur, but the energy produced it is extremely short in duration. The ATP-PCR system will last for about 10 seconds and is used for activities such as sprinting, shot putt, and vertical jumps.

The Glycolytic/Anaerobic System: The energy from this system is obtained by breaking down glucose that is stored in muscles or the blood stream. A by-

product of this system is lactic acid which causes a burning sensation within the muscle. If an activity is too intense, and there is no time for the body to clear out the lactic acid, then the activity cannot be maintained, and fatigue sets in. This system lasts for up to two minutes. High intensity, but short duration activities such as the 400-meter run or 200-meter swim are examples of the glycolytic energy system.

The Oxidative/Aerobic System: This is also known as the oxygen system and is mainly fueled by carbohydrates stored in muscles or from the blood stream. Oxygen must be present for this energy system to work. Activities lasting longer than two minutes rely on this energy system. If the activity is not too intense while using this system of energy, it can continue indefinitely, as long as the body has glucose, fat, and oxygen. If, however, the activity is intense, glucose may run out and the body will produce lactic acid. This reflects oxygen deficiency. Long distance running and cycling are examples of activities that use this energy system.

Table 2: Energy Systems Comparison Chart

	Aerobic	Anaerobic Glycolysis	Anaerobic ATP/PCr
Fuel	Carbohydrates (glucose/glycogen) Fatty acids	Carbohydrates Glucose/glycogen	Stored ATP and PCr
Duration	Sub-max activities lasting more than two minutes	High intensity activities lasting one to two minutes	High intensity activities lasting 1-10 seconds
Example Activities	70-80 % max heart rate • Running • Swimming • Cycling • Rowing	80-90 % max heart rate • Weight training • Interval training • Plyometrics • Speed and agility training	Explosive movements • Sprinting • Shot putt • Vertical jumps

- **Muscular Strength:** Muscular strength refers to the maximum force that can be generated by a muscle group. Muscular force is determined by the amount of Type I, IIa or IIb muscle fibers in use. Each type of muscle fiber has a specific purpose and these differences influence how muscles respond to training and physical activity. Type I muscle fibers are part of the oxidative energy system. When active, these muscle fibers produce a slow twitch movement. These muscle fibers are efficient at using oxygen to produce more fuel (ATP) for continuous, extended muscle contractions and can operate for a long time without fatigue. They have an extraordinary proficiency for aerobic energy supply, but are limited in rapid force development. Type I fibers are beneficial for endurance activities, such as marathons or triathlons.

  Type IIa muscle fibers are part of the oxidative and glycolytic energy systems, these fibers produce fast twitch muscular movements. These muscle fibers are

known as intermediate fast twitch fibers because they can use both aerobic and anaerobic energy systems almost equally to create force. More capillaries surround these fibers and they show greater resistance to fatigue. The third type of muscle fiber, Type IIb, also produces a fast twitch movement and gains its energy from the oxidative energy system. These muscle fibers use anaerobic energy and excel at producing quick, powerful bursts of speed. This type of muscle fiber has the highest rate of contraction, but it also has the highest rate of fatigue and cannot last for long periods of time before needing rest. It is important to note that your overriding muscle fiber type is genetically determined and cannot be changed, but it can be trained to become more effective.

Although gender doesn't impact the quality of muscle, it does affect the quantity. Men and women's muscle tissue is, as a rule, the same, but men normally have more muscle tissue than women do because muscle size is increased by the male sex hormone testosterone. The bigger the muscles, the stronger the person; this is why most men are viewed as stronger than most women. However, muscle strength is measured in two ways. Absolute muscle strength is measured as the total force in pounds. When put in these terms, men are usually stronger than women. The second method, relative muscle strength is measured as the total force divided by body mass, fat-free body mass, muscle cross section, limb volume, or girth. If measuring muscle strength with this method, the strength discrepancy between men and women is greatly diminished if not eliminated.

- **Muscular Endurance:** Muscular endurance is the ability of a muscle group to execute repeated contractions or an isometric contraction in which the length of the muscle remains the same for a specific period of time. It is possible to train for muscular strength or endurance, but training both areas allows Marines to achieve a more balanced performance. Muscular strength and endurance improve and maintain the body's resting metabolic rate, enhance lean mass, bone mass, glucose tolerance, the integrity of muscles and tendons, aid in the prevention of low back pain and joint or muscle injury, reduce the risk of osteoporosis, produce favorable changes in HDL levels and blood pressure, and improve the ability of the body to carry out everyday living activities. Muscular strength training will increase the size and density of muscles and muscles will become more defined through a combination of strength and endurance training.

  The body can experience strength losses and endurance losses if not trained properly. Strength losses can occur when there are long periods of rest between training sessions. The amount of loss depends on the muscle and the length of the period of inactivity. To counteract this, a lighter routine is recommended to retain the strength gained from physical conditioning. Noticeable decreases in performance can occur quickly. It is not unusual to see a decrease in performance in as little as two weeks if physical conditioning is decreased or stopped. The body can become completely detrained in as short a period as four to eight weeks. To avoid detraining, especially if injured, it is best to decrease the frequency of conditioning to one-third of normal frequency, or decrease the time of activity from one-third to two-thirds of normal activity time. As the saying goes, if you don't use it, you will lose it.

- **Flexibility:** The final component of physical fitness is flexibility. Flexibility is the ability of a joint to move through its complete range of motion. Not only is this important for daily living activities, but it is essential for optimal athletic performance. Flexibility is joint specific and is determined by the joint's range of motion (ROM). In any ROM, the elasticity and structural limit of each component determines the flexibility of the joint. Injury and other factors may limit a joint's flexibility. ROM will vary from person to person, but can be improved through static, dynamic, and contract-relax stretching. A minimum of 30 seconds should be spent on each stretch, and each stretch should be repeated three times. It is imperative stretches are not rushed. These movements should be done lightly after warm-up and as part of the cool down routine after exercise. For best conditioning results, all muscle groups should be included, and stretching exercises should be included before and after the focus exercise activity.

FITT Factors. The FITT factors are the basis for exercise prescription and are applied to the cardio-respiratory, flexibility, and muscular strength and endurance components of conditioning. Each element must be considered when performing a workout to provide maximum benefit to the participant.

- ***Frequency (F): How often?***
  - The number of days per week exercise sessions take place
  - Independent from intensity and time
  - Rest between sessions must be considered for muscle recovery time

- ***Intensity (I): How hard?***
  - The physiological stress on the body during exercise or the load worked against resistance, such as repetitions/sets, miles, meters, speed, incline, revolutions per minute (RPM)

- ***Time (T): How long? (duration)***
  - Amount of time devoted to completing the conditioning workout
  - Warm-up, stretching, conditioning activity, cool down must be considered

- ***Type (T): What activity? (method)***
  - Cardio
  - Strength training
  - Flexibility
  - Program progression

To take full advantage of a physical conditioning program, utilize progression for the FITT factors as outlined below.

- Only progress one component at a time.
- Watch for appropriateness of progression.
- Adhere to the 10 percent rule – progress no more than 10 percent beyond current fitness level.

Principles of Fitness. There are five principles inherent to developing a conditioning program.

- **Specificity:** Specificity refers to the exercise done and the muscles involved, but also to the training program. It must be relevant to the demands of the event for which the athlete or in this case, the Marine, is being trained. Energy systems and movement patterns should also be considered.

- **Overload:** Increasing the resistance to movement, or the frequency or duration of activity to levels above those normally experienced denotes overload. In order to progress your body, it must be pushed to the next level. For example, increasing the number of push-ups over time overloads the muscles and, in turn, causes them to progress.

- **Progression:** Progression permits the body's conditioning to advance. This process requires increasing the reps, sets, frequency, weight of lifted objects, and so forth, to cause the body's muscles to engage at a more intense level. To achieve progression successfully, never increase more than one element at a time and never by more than 10 percent.

- **Individuality:** Remember that because everyone is different, each person's response to exercise will vary. PT coordinators must pay special attention to each participant's muscle fiber type, flexibility/biomechanics, age, gender, fitness level, and injuries or illness to provide individualized assistance and support when the conditioning program or workout is conducted.

- **Recovery:** The process of recuperation after physical conditioning is essential to decrease injury. Recovery includes the time and environment needed for the body to adapt to the demands that have been placed upon it. Rest, hydration, nutrition, and active rest are essential to building a strong Marine. Active rest requires continued workouts, but changing the pattern of normal training to avoid plateaus so the body will continue to make gains. Active rest includes those activities you don't normally partake in. Active rest is also a common and effective way to combat overuse injuries. Light exercises such as swimming or cycling stimulate the recovery process without imposing undue stress on the injured body part.

Periodization. Every useful conditioning program includes the process of variation to bring about optimal gains in physical performance, while reducing the risk of overtraining. This process is known as periodization. The benefits of reviewing and modifying a program over time include improved:

- Muscular endurance
- Muscular strength
- Power
- Motor performance
- Muscular hypertrophy

There are three periodization cycles when changing a program is considered valuable and warranted. The microcycle includes daily and weekly variations in volume, intensity and exercise selection. The mesocycle is a collection of microcycles and is the major training phase conducted over a year's time in three or four week to three month intervals. The variation in volume and intensity allows participants to progress in their individual conditioning. The macrocycle includes the entire year's training period and includes a well-designed progression plan intended to advance participants' level of fitness beyond their starting level.

Functional Fitness

Functional Training. Functional training is a system of conditioning activities that are designed for the specific purpose of enhancing one's performance in life, combat, sport, and/or activity. It is dynamic, multi-planar, multi-directional, rotational, specific to the sport or activity, and trains the body in the way it's supposed to move.

Functional strength relates to training for performance and movements applicable to combat and other activities of daily living. Developing specific strength, flexibility and agility will enable results that achieve combat readiness. Train with a purpose, train with intent, train for the mission.

Traditional training primarily incorporated running, standard weight lifting, basketball, walleyball, and other similar activities. Traditional fitness training is still important but will not adequately prepare Marines for the combat fitness test (CFT). Marines must multi-train to be successful with the CFT and the physical fitness test (PFT). Combat fitness training is necessary for preparing energy systems and for providing functional training relied on in combat, but it also helps Marines improve their PFT.

There are four pillars of human movement that are inherent when training.

- Locomotion**:** Moving in any direction
- Rotation**:** Rotational movement
- Change in center of gravity**:** Center of mass gets higher or lower
- Push/Pull**:** Bringing an object closer to, or pushing it away from, the body

The Balanced Workout. The making of a tactical athlete relies on a workout that is balanced. Marines' fitness regimes should include:

- **The Dynamic Warm-up:** The dynamic warm-up includes integrated flexibility and joint stabilization exercises. These exercises elevate tissue temperature, increase Marines' range of motion, elongate connective tissue, reduce muscular tension, aid in coordination, and develop body awareness. It also improves posture, reduces risk of injuries, lasts for up to 15 minutes, feels good and prepares Marines for more intense activities. It achieves preparation by loosening the mind's control over the body and priming the neuromuscular system thus allowing the cardiovascular system to adjust blood flow. Muscle groups that are the prime movers (agonists), as well as muscles that assist the prime movers (synergists) during functional movement patterns, are

strengthened through these warm-up exercises. The selected exercises should be specific to an activity and provide multi-planar movements that integrate ranges of motion specific to that activity to reduce potential injury.

- **Balance:** Balance is critical for performing activities with ease and minimal injury. Balance is the ability of the body to maintain a desired posture either static or while moving. Barriers to good balance include a lack of endurance, strength, and concentration, and/or sustaining an injury, illness, or disease. Proprioception, which is the instinctive perception of movement and spatial orientation arising from stimuli within the body, can also impair balance. Vital benefits of good balance for Marines include remaining stable in all conditions including those with surface changes or when the center of gravity shifts, as well as, the ability to move in unpredictable conditions.

- **Coordination:** Coordination is a skill-related component of physical fitness that relates to the ability to use the senses, such as sight and hearing, together with body parts in performing motor tasks smoothly and accurately. Specifically it is the movement performed by body parts that can be described as smooth and accurate. Coordination and agility are often confused. Agility is the ability to decelerate, accelerate and change the direction of the entire body as quickly as possible in the shortest amount of time possible. Agility hinges on Marines' quickness. This is the ability to react to a stimulus in the shortest amount of time possible. It relies on training the nervous system to react and then move the feet as fast as possible in a variety of patterns.

- **The Core**: The core must be strengthened and maintained to perform combat tasks with the least potential for injury. The core supports the spine and all movement of the body which includes the trunk. Movements take place along three planes, the sagittal, frontal, and transverse. The sagittal plane includes forward and backward movements such as bicep curls, sit-ups and back extensions. The frontal plane consists of side-to-side movements such as side bends or lateral raises. Movements that require rotation are included in the transverse plane. These include movements such as floor to overhead diagonals with the arms holding a medicine ball.

- **Power:** Power is the time or rate at which work is done or energy is transferred. The maximum amount of force a muscle generates under a specific set of conditions and the speed or ability to move from one point to another as fast as possible combine to yield the power with which the object moves. In physical activity, power is the ability of the neuromuscular system to act with force. Olympic lift exercises like the clean and jerk, snatch, and dead lift support training for power. These exercises are also performed using kettlebells, dumbbells or ammo cans and are practiced in practical session workouts.

  Another method of developing power is plyometrics. Plyometric movements use the strength, elasticity and innervation of muscles and surrounding tissues to jump higher, throw farther or hit harder, depending on the desired training goal. This type of exercise training is done on a soft surface and is designed to produce fast, powerful movements, and improve the functions of the nervous

system. These exercises enable a muscle to reach maximum strength in as short a time as possible. Muscles go through a stretch reflex providing the ability to react quickly at any given time.

Plyometric drills are a fundamental part of combat conditioning training. They help develop rhythm, speed, power and muscular endurance. Training focuses on rapid deceleration and acceleration of muscles that create a stretch-shortening cycle. When executing these drills, strive for speed of execution and visualize the ground on fire. Limit ground contact, land softly, and explode immediately after. In these drills, the quality of the exercise is more highly valued than the quantity of touches. Recovery between all sets is also essential to maintain form. Beginners should aim for 80 to 100 touches or foot strikes per workout, while highly trained Marines should achieve between 200 and 400 touches or foot strikes per workout. Examples include, bounding, jumping, hopping, skipping, and hurdles.

- **Flexibility:** Flexibility training assists in balancing muscle groups that may be overused during exercise or physical activity or as a result of bad posture. Physical performance is enhanced when a safe and effective flexibility training program is part of the Marines' workout. A flexible joint can move through a greater range of motion and requires less energy to do so. The risk of injury is also greatly decreased. Static stretching movements have also been proven to help reduce muscle soreness after exercise. Static stretching involves a slow, gradual and controlled elongation of the muscle through the full range of motion. The stretch is held for 20-30 seconds in the furthest comfortable position (without pain). Since soft-tissue structures may adapt poorly to either the effects of gravity or poor postural habits, stretching can also improve muscular balance and posture. Stretching can aid in realigning soft tissue structures, thereby decreasing the energy it takes to achieve and maintain good posture in the activities of daily living.

Injury Prevention

Injury prevention is a critical element of physical conditioning. Recognizing how to avoid injury and what to do if an injury occurs will greatly impact the amount of time needed to recover. There are five areas of concern: risk factors, common injuries and their prevention, overtraining and detraining, heat and cold injuries, and high-altitude preparation.

Risk Factors. Marines have specific risk factors when it comes to physical conditioning. Among those of greatest concern are:

- Increasing the volume of training too quickly
- Low levels of physical fitness
- History of previous injury
- High volume training
- Smoking
- Poor flexibility
- Gear

Common Injuries and Prevention. Research has identified physical training and vigorous operational activities as the most common causes of injuries requiring patient care and limited duty. According to the *Atlas of Injuries in the U.S. Armed Forces* Supplement to Military Medicine Vol. 164, No. 8, August 1999, research on Marine Corps recruits by the National Health Research Center (NHRC) shows that reductions in the amount of running and gradual progression of intense physical training can effectively reduce the incidence of stress fractures without sacrificing physical fitness. Physical conditioning should emphasize functional exercises over traditional modes of working out.

Shoes should be replaced every three months or 300 miles. Today's shoes are made differently. They are lighter and therefore breakdown sooner. Orthotics purchased off the shelf should be replaced every six months. For best results, look for a brand that can be molded for a more custom fit. Custom-made orthotics should be reevaluated every year. Running shoes should give at the toe box. Consider locating a running store that will watch your gait to determine proper footwear.

Pre-existing injuries, overtraining, decreased physical fitness levels, and behavioral factors, such as smoking or other adverse health behaviors, are considered modifiable factors since these can be altered. Research shows smoking puts a Marine at increased risk of fractures because tobacco negatively impacts bone density.

Basic trainees who are the least physically active prior to entering the Marine Corps are at greater risk of injury during basic training. Once an injury occurs, a Marine should follow the protocol below to decrease the chances of re-injury.

- Establish communication with your medical team
- Seek medical clearance for activity
- Once clearance is received, address the injury with activity per provider's orders
- Progress slowly and gradually

- Avoid activity that will increase inflammation
- Maintain pain-free range of motion (ROM)

Note that the provider is specific to your installation, and can consist of physical therapists, certified athletic trainer (ATC), physician's assistant (PA), general medical officer (GMO) or a nurse practitioner (NP).

Chronic injuries are those that place a demand greater than the body's physical limitations can withstand and often occur with repetitive motion. These injuries require additional care. It is recommended the injury site be heated for 20 minutes before activity and iced for 20 minutes after activity. Proper support (i.e. bracing, athletic gear-shoes, surfaces) should be provided to decrease aggravation or improper ROM. Modifying the activity is also recommended to aid in recovery. Proper rest is also necessary and medical attention should be sought as needed.

Preventing injury in the first place is a goal of combat conditioning, but injuries will occur. Common athletic injuries are categorized as chronic or acute. Chronic injuries last over a period of time, while acute injuries have rapid onset, and usually subside over a short period of time. Examples follow.

Table 3: Types of Injuries

Acute	Chronic
Cuts, bruises, and scratches	Cartilage tears
Muscle pulls and strains	Fractures/stress fractures
Ligament sprains and ruptures	Tendonitis
Tendon sprains and swelling	Shin splints
Dislocations	Shoulder impingement

Injury warning signs include pain, tenderness at a specific point, swelling, reduced range of motion, comparative weakness, and numbness and tingling. The injured site may also become red in color and feel warm to the touch. Treating an injury quickly will produce a better outcome for recovery. Utilize PRICE: protect, rest, ice, compression, elevation.

Preventing injury is every Marine's responsibility. Refer to Table 4 to review potential injuries, their causes and prevention methods that can be incorporated into preparing for workouts to decrease the possibility of injury. Exercise training should mimic the physical application the Marine will participate in, especially if combat is expected. Attention must be paid to cardiovascular conditioning, muscular strength, muscular endurance, flexibility, and body composition. Conditioning should also include a variety of exercises to support and maintain all areas of fitness. Personal responsibility for injury prevention requires using the right shoe for the right exercise as well as appropriate replacement when shoes are worn out. Marines must also maintain hydration when working out. Training should follow a cycle of progression and focus on proper technique, execution, and recovery. Recognizing muscular imbalances and implementing a plan to compensate or strengthen weaknesses is vital. Marines must also detect injuries early and intervene to prevent chronic injuries from developing.

Marines responsible for the physical training of others have additional obligations to mitigate injuries. Check equipment frequently for wear and tear. Check fields and playing areas for potential hazards. Provide appropriate training schedules and routines for those you train. Being aware of potential injuries and how they may be prevented is also beneficial when determining the exercises and routines that will be implemented for PT or combat conditioning training.

Table 4: Injury Causes and Prevention

Potential Injury: Causes and Prevention		
Body Part	**Cause/s**	**Prevention**
Shoulder separation/dislocation	Bones of shoulder joint come apart as a result of a blow or a particular movement.	Difficult to prevent, however strengthening and stretching of the shoulder area will help improve integrity of shoulder musculature and tendons.
Shoulder tendonitis	Irritation of the tendons or muscles surrounding the shoulder area caused by overuse.	Best prevention is a gradual, intelligent training program including strengthening and flexibility exercises.
Wrist injuries/sprains	Falling with an outstretched arm on hard surfaces or an over-stretching of the tendons of the wrist.	Pad area, increase strength and flexibility of hand/wrist area, and learn proper falling technique.
Low back pain/herniated disk	Poor posture, lack of proper exercise, traumatic injury.	Exercise; correct postural issues and increase flexibility of back and hamstring muscles.
Pelvic stress fractures	Overuse, repetitive movement under heavy loads.	Gradual increase of exercise and loads.
Hamstring pull	An overstretching, partial tear or rupture of the hamstrings from overuse or traumatic injury.	Sufficient warm-up and stretching of area prior to any activity in which there is a sharp, sudden pull on the muscles. Adequate strengthening.
Ligament injuries of the knee	Blows to lateral aspect of knee, improper landing.	Build strength of quadriceps to help secure knee joints. Correct running and landing technique.

Table 4: Injury Causes and Prevention (con't)

Potential Injury: Causes and Prevention		
Body Part	**Cause/s**	**Prevention**
Cartilage injuries of the knee	Direct blow to knee or if a great deal of stress is applied to the knee joint without using proper technique.	Proper lifting and running techniques and strength conditioning for the knee.
Ilio-Tibial band syndrome	Repetitive movements, overuse, lack of flexibility in hip.	Proper progression in activity and stretching.
Shin splints	Improper activity progress, overuse, old or inappropriate running shoes/orthotics.	Gradual build-up in training program to include different training surfaces. Proper type and fit of running shoe. Orthotics if needed.
Achilles tendonitis	Training on hills and hard surfaces, overuse, improper footwear.	Gradual conditioning program. Develop and maintain strength in the muscles at the front and back of the ankle joint.
Ankle sprains	Generally inversion injuries from uneven training surfaces or improper technique.	Increase strength of ankle area. Improve ankle flexibility and balance.
Stress fractures	Overuse and load bearing activities.	Best possible footwear and/or orthotics. Progressive build-up in training.

Overtraining and Detraining. Overtraining can bring about its own set of problems for Marines. Signs and symptoms of overtraining are: fatigue, anemia, amenorrhea (or loss of the menstrual cycle in women), sleep disturbances, lack of motivation, increased resting heart rate, muscle spasms, change in mood, and overuse injuries that include stress fractures, tendonitis, bursitis, shin splints, and chronic knee pain. Overtraining can be avoided by establishing goals that are realistic. First, if responsible for their training, confirm the current fitness level of the Marines. Group individuals with the same or similar fitness levels (ability grouping). Establish short-term and long-term goals for each group or each individual. Progress slowly and gradually and add variety. Reinforce the Semper Fit resources that are available to individual Marines (e.g., personal trainers, health educators, athletic trainers, fitness center managers, dieticians) should they be needed to enhance performance. While conducting combat conditioning, remind Marines to listen to their bodies. Pain is a sign that something is wrong. General fatigue after conditioning is good, but pain is not. Delayed onset muscle soreness (DOMS) may occur 48-72 hours after an event. Lactic acid "burn" will

decrease as the body progresses and becomes more effective and conditioned to physical activity.

Preparation and combat readiness may be negatively impacted if Marines undergo detraining. The principle of detraining refers to the “use it or lose it” concept. Detraining is defined as a cessation in training or a substantial reduction in frequency, volume and/or intensity. How quickly Marines lose a fitness level depends on how conditioned they are, how long they have been exercising, and on how long they stop. Studies of individuals starting a new exercise program that trained for two months then stopped for two months, showed aerobic gains were lost and had returned to start levels. On the flip side, well-conditioned athletes who had trained for one year, then stopped exercising entirely, lost about half of their aerobic conditioning after three months. Considering the likelihood of combat service, Marines in top physical condition are better prepared for the dangers they face in combat. To avoid the negative impact of detraining, consider decreasing training levels rather than stopping completely.

Heat and Cold Injuries. Heat injuries can significantly injure a Marine. Heat injuries can take three forms, heat cramps, heat exhaustion, and heat stroke. Heat cramps presents with severe cramping of skeletal muscles, mineral losses, dehydration and is accompanied by high rates of sweating. It is treated by moving the individual to a cooler location and administering fluids or a saline solution. Heat exhaustion is a more serious condition. Symptoms of heat exhaustion are extreme fatigue, breathlessness, dizziness, vomiting, fainting, cold and clammy or hot and dry skin, hypotension, and a weak, rapid pulse. The cardiovascular system experiences an inability to adequately meet the body’s needs, and blood volume is reduced from sweating. Heat exhaustion can occur during mild to moderate exercise in the heat. To counter the effects, rest in a cooler environment with feet elevated to avoid shock, and administer salt water. If unconscious, medical assistance is required. Heat stroke is a life threatening circumstance. A person with this condition will undergo a rise in body temperature exceeding 104° degrees, stop sweating, the skin will feel hot and dry and experience a rapid pulse and respirations. Usually the person will become hypertensive, and as the blood pressure rises, confusion and unconsciousness may occur. If left untreated, heat stroke progresses to coma and death quickly follows.

The incidence of these conditions can be reduced by acclimatizing to heat and humidity levels. Heat acclimatization requires more than mere exposure to a hot environment. It is dependent on environmental conditions during each exercise session, the duration of heat exposure, and the rate of internal heat production from the intensity of exercise performed. The process of acclimating should take place over several days. To begin, perform low-moderate intensity workouts in the heat for 5 -10 days. Cardiovascular changes will generally occur in the first three to five days. Sweating mechanisms usually take up to 10 days. Workout intensity should be reduced to 60-70 percent during the first few days to prevent excessive heat stress. Individuals in training should be alert to any symptoms and consume as much fluid as possible.

It is important to keep yourself hydrated not only as a weight loss tool, to help you eat less food, but also because it affects your activity level. Dehydration can occur in any weather condition; hot or cold. When a person is dehydrated their mental and physical activity is affected. Often thirst is used as an indicator for dehydration; however, if you

are thirsty you are already dehydrated. Checking the color of your urine is a more effective way of monitoring your hydration status. Your urine color should be pale yellow and odorless. Your urine color will not only be affected if you are dehydrated but also if you are taking any supplements. Keep yourself hydrated by drinking at least 8-10 glasses of cold water a day.

Cold injuries are just as debilitating for Marines. If a cold injury is suspected, get out of the cold as quickly as possible. Cold weather injuries include frostbite, hypothermia and trench foot.

Mild frostbite presents with a change in skin color from red to white. The skin will also feel waxy. Numbness will occur in the affected area. If mild frostbite is experienced, do not massage but instead warm the affected area using body heat. Late stage frostbite is a more serious condition. The skin will appear mottled and blotchy, turn yellow and progress to a grayish-blue color. In this instance, medical attention should be sought immediately and the affected area should not be massaged.

Mild hypothermia will begin with uncontrolled shivering and numbness, and can also include slurred speech and loss of coordination and fatigue. To treat this condition, keep the person warm and dry. If clothing is wet, remove it. Warm the person's core before the extremities to keep the blood circulating to the organs. As hypothermia advances, symptoms become more debilitating. The victim will experience drowsiness and suffer an inability to perform simple tasks. The person's pulse and breathing will slow, a glassy stare will set in as eyesight begins to fail and the person will move to a state of unconsciousness. Treatment should include all of the steps for mild hypothermia but the person should be placed in a head-down position and moved gently. Transport to a medical facility should also be a priority.

Trench foot, also known as immersion foot, can result if feet are exposed to wet conditions for an extended period of time. Tingling and/or itching, pain, swelling, cold and blotchy skin, numbness and a prickly or heavy feeling in the foot are all symptoms. After an affected foot or feet become warm, they may be red, dry, and painful. Blisters may form and lead to skin and tissue dying and falling off. In severe cases, trench foot can impact the toes, heel or entire foot. If a foot wound already exists, it may be more prone to infection, so check feet at least once a day for infections. Prevent trench foot by air-drying and elevating feet. Replace wet shoes and socks for dry ones. If trench foot does occur, thoroughly clean and dry feet and replace socks daily with clean, dry socks. Do not wear socks when sleeping or resting. Treat the affected part of the foot by applying warm pack or soaking feet in warm water (102° to 110° F) for about five minutes. Seek medical attention as soon as possible.

Cold weather injuries can be decreased by: dressing in layers, staying dry and keeping your feet dry, choosing appropriate gear, remembering to wear sunscreen, drinking plenty of fluids, paying attention to wind chill and, most importantly, knowing when to call it quits. Dressing for cold weather conditions should start with a thin layer of synthetic material such as polypropylene, which draws sweat away from your body. Next try fleece for insulation. Top this with a waterproof, breathable outer layer. To warm the air you breathe, wear a face mask or a scarf over your mouth. Wear a hat and gloves. Snow reflects the sun's rays, so sunburn is possible even if you are cold.

Sunscreen and lip balm will protect the skin. Drink water or sports drinks before, during and after your workout, even if you're not thirsty. You will be less likely to get chilled if you begin your workout by heading into the wind on windy days, and end your workout when you become sweaty, or with the wind at your back. The wind can penetrate your clothes and remove the insulating layer of warm air that surrounds your body. Fast motion also creates wind chill because it increases air movement past your body. When the temperature is 10° F and the air is calm, skiing at 20 miles an hour creates a wind chill of minus 9°. If the temperature dips well below zero or the wind chill is below minus 20°, choose an indoor activity instead.

High Altitude Preparation. Performance in high altitudes also requires special consideration to perform at optimum levels. Acclimatization takes approximately two weeks. Until this process is complete, cardiovascular endurance is hindered due to less oxygen in the lungs, and a greater percentage of energy needs are met by anaerobic (without oxygen) energy systems. With this comes increased lactic acid production and rapid onset of fatigue. Mental performance can also be compromised. The brain and nervous system may react slowly due to low oxygen conditions. Changes in memory and vision, insomnia, and mood changes are possible. Another concern is high altitude illness. Acute Mountain Sickness (AMS) is exhibited by nausea, and/or vomiting due to rapid exposure to the high altitude without acclimatization. If symptoms are experienced, consume carbohydrates, drink plenty of water, and return to a lower altitude if possible and seek medical attention.

Tactical Nutrition

Tactical nutrition is essential for good health and continued wellness. It encompasses the choices Marines make each day when selecting nutrients, determining the calories in food, vitamins and minerals, alcohol consumption, and what, if any, supplements to ingest. Armed with information about each, a Marine can make well-informed decisions about health and wellness for a lifetime.

Nutrients and Calories. Eating a balanced diet is important for maintaining a healthy weight and for providing the nutrients to maintain good health. A good balance for a meal is 45-65 percent carbohydrates, 10-35 percent protein and 20-35 percent fat. However, depending upon your activity level these percentages can change. Proper nutrition is all about variety, moderation, and portion sizes. All types of foods fit into a healthy meal plan. Table 5 reviews how food is broken down in the body and stored for future energy use.

Carbohydrates (CHO) are the primary fuel source for muscle function during exercise, especially hard exercise. It helps prevent protein from being used as an energy source. During digestion your body converts CHO into sugar and the sugar enters your blood stream where it is transferred to individual cells to provide energy. It is important to include CHO in your diet since they provide faster recovery from exercise, maintain immune function, and postpone fatigue when working out. There are two main groups of carbohydrates in the diet: complex CHO (i.e., whole wheat breads, beans, rice, and pasta) which contain fiber and simple CHO (i.e., sugar cereals, soda, candy) which contain added sugar.

Proteins are essential for growth, maintenance and repair of the body's cells. Proteins form enzymes, hormones and antibodies. They also support cell structure, muscles and cell membranes. Athletes only need slightly more protein than non-athletes. The protein needs of athletes have received considerable investigation. The misguided theory is if you eat a lot of protein you will build a lot of muscle, but extra protein does not build extra muscle; exercises like weight lifting, push-ups, and other forms of resistance training build and strengthen muscles.

The best diet contains adequate but not excessive protein to build and repair muscle tissues, grow hair and fingernails, produce hormones, boost your immune system and replace red blood cells. In general, 0.8 – 1.5 grams of protein per kilogram of body weight is one way to determine your protein needs, but how much protein you need depends on a few things. The recommended daily allowance (RDA) for protein is 0.8 grams of protein per kilogram of body weight. To calculate your protein needs, take your weight in pounds and divide it by 2.2. This converts your weight into kilograms. Next, take your weight in kilograms and multiply it by 0.8 or up to 1.5. This roughly equals the grams of protein needed per day.

Marines should be aware that increasing protein intake beyond the recommended level is unlikely to result in additional increases in lean tissue. This is due to a limit at which the rate of protein can be accrued within the body. Too much protein can result in nutrient imbalance, kidney strain, dehydration, and excess body weight. It is important to make certain the daily energy intake is adequate, otherwise protein will be used as an

energy source. Remember too that muscle strength, size and shape come from exercise.

Fats are another essential part of good nutrition. Fats are an essential part of the diet, regardless of their bad reputation. These are some of their main functions:

- Provide nutrients, vitamins, and energy
- Line and insulate the nerves of the brain and body
- Aid in the manufacturing of antibodies

Aerobic exercise training increases the ability of the muscles to use fat as an energy source. Regular training improves your body's ability to use fat as a fuel source. Marines should try to consume 20 – 30 percent of their total calories from fat. Too high or low a percentage of fat within the body will, however, have negative effects on the blood lipid profile.

Fat mobilized from your body's fat stores is an important source of fuel during certain stages of exercise. Regular training improves your body's ability to use fat as a fuel source. Fat also supports your joints. For example, the padding around your finger tips and hips helps prevent bruising.

The three types of fat are saturated, unsaturated and trans fat. Saturated fats are found in animal products. Examples include the skin on chicken or the fat around a steak, whole milk, cheddar cheese, stick butter and processed meats. Unsaturated fats are good for your heart. These branch out to monounsaturated, polyunsaturated and omega 3, 6, and 9. Some examples of where you can find these fats are tuna, salmon, olive and canola oils, flax seed and wheat germ. Trans fat is found in processed foods. Manufacturers add hydrogen to vegetable oil through a process called hydrogenation. Hydrogenation increases the shelf life and flavor stability of foods containing this fat. At one time, trans fat was found in just about anything that was processed. Most manufacturers now know that consumers are aware trans fat is harmful to their health, and have decreased their inclusion in processed foods. However, items such as biscuits, croissants, and pie crusts are likely to contain it.

Table 5: Metabolic Energy Review

Metabolic Energy Review		
Food Component	**Is broken down in the body to:**	**And then ends up as:**
Carbohydrate	Glucose	Liver and muscle glycogen stores
Protein	Amino Acids	Nitrogen lost in the urine
Fat	Fatty acids	Body fat stores

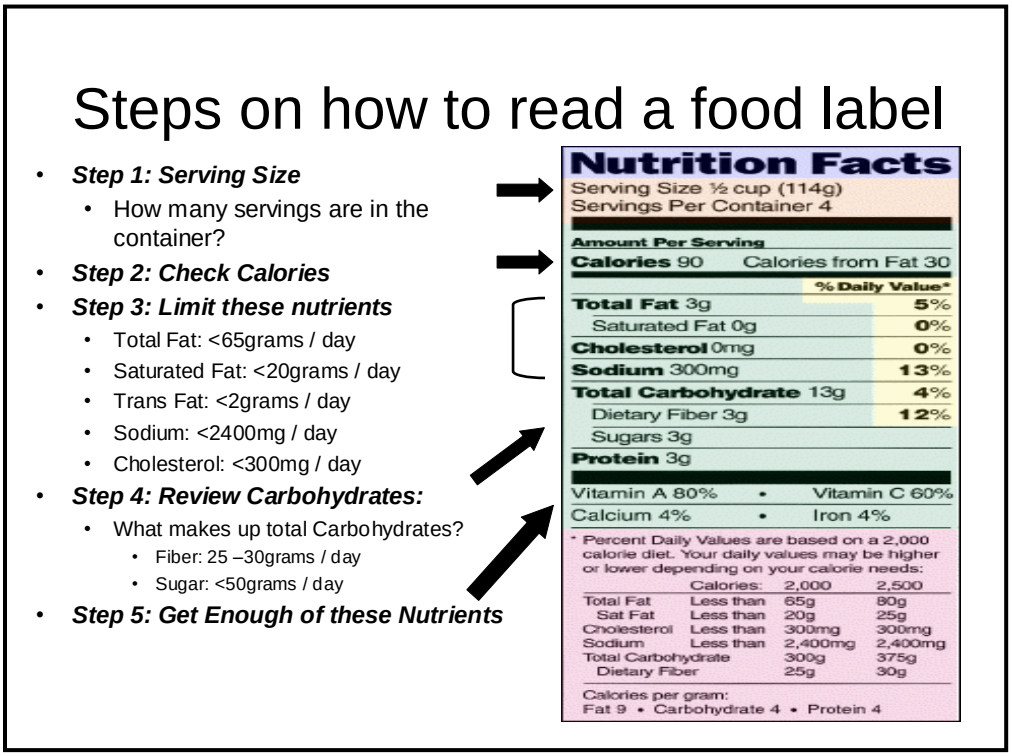
Marines in the field rely on Meals Ready to Eat (MRE) for their nutritional needs. One MRE equals one meal. An MRE contains on average 1250 calories. A rough breakdown of an average meal is 13 percent protein, 36 percent fat and 51 percent carbohydrate. This meets about one-third of the military recommended daily allowance.

Three MREs a day are recommended for active duty on patrol or on the front line, for an average of 3750 calories per day.

Many active duty Marines gain roughly 10 to15 pounds when deployed, while others drop 10 – 15 pounds. When a Marine is not deployed, hidden calories from unexpected sources can sneak into the recommended daily allowance of calories. Take for example soft drinks. A typical 12-ounce soda has roughly 40 grams sugar. A 64-ounce soda from the corner store, has a total of 212 grams of sugar, an equivalent of 53 teaspoons of sugar. Fast foods and processed foods often contain large quantities of fats and sugars. If fast food or processed foods are eaten regularly and not metabolized by the body or burned off through exercise, they can quickly add additional weight to the body.

Portion size has also changed. When eating out, the portion may contain far more calories than you may think. A bagel 20 years ago was three inches in diameter and contained 140 calories. Today's average bagel has about 350 calories. The best defense when consuming food you have not prepared yourself is to read the nutritional information on an item. Fast food chains and restaurants may have this information available on site, on their menu, or at their website. Food purchased in the commissary or grocery store will contain information on the item's packaging (See Figure 2).

Figure 2: Reading a Food Label



Vitamins and Minerals

Vitamins are metabolic catalysts that regulate biochemical reactions within the body. Minerals are natural substances that have unique metabolic roles. To date there are 14 vitamins and 15 minerals that have been discovered, each with a specific function. You

need adequate vitamins and minerals to function properly, but no scientific evidence to date proves that ingesting more than the daily recommendation offers a competitive edge. Vitamins and minerals do not provide energy but facilitate energy-yielding chemical reactions.

Deficiencies of vitamins and minerals do not develop overnight but over a course of months or years. Examples include a person with anorexia or one who eats an inadequate vegetarian diet. In fact, the body stores some vitamins in stockpiles (A, D, E, K—fat soluble) and others in smaller amounts (B, C - water-soluble vitamins). Hence, one day of suboptimal eating will not result in a nutritionally depleted body. Remember, more is not always better!

Water-soluble vitamins are not stored in mass in the body. The body will excrete any extra. These include vitamin C which strengthens the walls of the blood vessels and aids in wound healing and immunity, as well as Vitamin B Complex which maintains the health of skin, intestines, and nervous system.

How do you determine the amount of vitamins and minerals you should consume? Once again food labels come into play. Food labels list the percentages contained in the item as well as the recommended daily intakes or the amount of nutrients a person should get each day. These numbers tell you the Percent Daily Value (%DV) that one serving of this food item provides as a percentage of the established standards. Percent DV is based on a 2,000-calorie diet for adults older than 18. By using the Percent DV, you can compare similar foods in order to help determine which foods are higher in nutrients. Anything over 100 – 150 percent of the daily value is excess.

Fat-soluble vitamins are stored in the body, and, if taken in excess, may become toxic. Vitamin A helps maintain a healthy skin tone, eyesight, promotes growth, and helps build antibodies. Vitamin D is processed by exposure to sunlight. It helps build strong bones and joints. Vitamin E is an antioxidant and delays the aging process and also promotes healthy skin and hair. Lastly, Vitamin K aids in blood coagulation.

If you are unsure you are getting the right amount of vitamins and minerals from your diet, you may choose to take vitamin or mineral supplements. When choosing these, be sure to look for labels that include seals from the United States Pharmacopoeia or Consumer Lab. This will ensure the company participated in independent product testing, and an inspection of the manufacturing plant has been conducted to verify quality control of the product.

Alcohol Consumption. Alcohol is very nutrient-dense providing seven calories per gram. However, when it is consumed, alcohol provides empty calories. Alcohol will also decrease a person's appetite. It is a poor source of fluids and will dehydrate the body producing a hangover. Over time, alcohol decreases the absorption of vitamins and displaces the caloric value of nutrient-dense foods in the diet. Alcohol also depletes the liver's glycogen stores and impairs its capacity to form new glucose.

Supplements. What exactly is a supplement? It is a product taken by mouth that contains a "dietary ingredient" intended to *supplement* the diet. Dietary ingredients in these products can include vitamins, minerals, herbs, botanicals, amino acids,

enzymes, organ tissues, gland tissue or secretions. No government testing is currently required for supplements.

People who use supplements are often looking for an extra edge, better results than they are currently getting from whatever they are doing for health and wellness, or they are used for quick results with minimal effort - the easy way out. The choice to use a dietary supplement can be a wise decision that provides health benefits if researched well. However, under certain circumstances, these products may be unnecessary for good health or they can create unexpected risks. Be aware of claims associated with supplements. Promises of quick weight loss or muscle gain, restrictions of any one food or food group or recommendations to begin a very low in calories diet (VLCD), that is between 800-1000 calories a day, should be researched or discussed further with your doctor. Remember claims that sound too good to be true such as, eat all you want, promises of an easy solution to your problem, or breakthrough findings without scientific evidence to support such claims, should send up red flags to investigate the supplement further.

If you choose to use supplements, consider the following questions before making your purchase.

- Is the supplement backed up by independent research on humans?
- Will the supplement help achieve your performance goals?
- Will it compromise your health or well being?
- Does the product interact with certain medications?

Eating for Performance. Armed with the information on how food provides for a Marine's nutritional and energy needs, when should a Marine eat before exercise? The answer is before and after exercising. Eating prior to a workout gives Marines the energy to increase the intensity of the workout and also increases the number of calories burned during exercise. It will also produce weight loss. It is best to eat 30 minutes to two hours before exercise. A simple and bland carbohydrate rich meal, like a bagel, toast, or cereal along with a glass of juice, and a piece of fruit will provide the energy needed for a beneficial workout.

During exercise, stay hydrated. Use a drink that has electrolytes with a small amount of carbohydrate. These include some sports drinks or diluted fruit juice. Your body can store about 1800 calories worth of carbohydrates (CHO) as glycogen in your muscles and liver. Muscle glycogen, liver glycogen and blood glucose will hold the stored glycogen, but if exercising lasts longer than 60 minutes hydration will help maintain the electrolyte balance and prevent hitting the wall of fatigue. While exercising, 0.5 CHO/lb of body weight per hour are used for energy. Drinking four cups of a sports drink along with eating a banana replenishes the body and stabilizes the body's metabolism.

Sports drinks such as Gatorade or PowerAde are mostly made up of sugar and are considered empty calories. For example, 32 ounces of Gatorade is the equivalent of 200 calories and 56 grams of sugar. These drinks are only needed when exercise is longer than 60 minutes and replenishment of glycogen stores are needed.

Energy drinks are a supplement that many Marines may consider drinking. Be aware these drinks increase a person's heart rate, blood pressure, and dehydrate the body. It is best to never use these when exercising. The combination of fluid loss from sweating and the diuretic quality of the caffeine contained in these products can leave the user severely dehydrated!

After exercise, it is extremely important to eat. Marines with a physical MOS or those choosing to exercise twice per day need nourishment to replenish energy used in a workout. To optimize muscle glycogen replenishment, consume CHO rich foods and beverages within 15 minutes after a workout. During this time, the enzymes responsible for making glycogen are most active and will rapidly replace the depleted glycogen stores. The target range is 0.5 grams of CHO per pound of body weight every hour or two. A small amount of protein such as chocolate milk, a slice of turkey with a bagel, or a peanut butter and jelly sandwich should be consumed. This helps stimulate the action of insulin, a hormone that transports glucose from the blood into the muscles.

What is the best timing for meals? Eating throughout the day helps maintain energy levels and burns more calories. By eating five to six meals a day, nutrients are supplied in more manageable portions causing blood glucose levels to remain balanced. When weight loss is the goal, eating smaller meals prevents overeating. If weight gain is the goal, focus on larger meals and liquids with calories.

To achieve long-term weight loss, decrease the daily consumption of calories by 250 to 1000 calories per day, and increase physical activity to burn between 250 and 500 calories per day. Be consistent with physical activity and focus on cardiovascular activities, but do not forget strength training and flexibility since these are needed to maintain muscle mass and prevent injuries. Lastly, eat a balanced diet, consuming 55 percent carbohydrates, 15 percent protein and less than 30 percent fat per day.

If long-term weight gain is the goal, increase the daily consumption of calories by 250 to 1000 calories per day to gain one to two pounds per week. Increased weight training will build muscle mass, but consistent physical activity should also include cardiovascular exercises that focus on strength and flexibility. A healthy balanced diet of 55 percent carbohydrates, 15 percent protein and less than 30 percent fat per day will supply the calories needed to promote a healthy weight gain.

Water should really be the bottom of the food guide pyramid. It has so many vital functions to the human body and can be a valuable weight loss aid. Water is essential for performance. It regulates body temperature, carries nutrients and oxygen cells, cushions joints, and aids in weight management. Sixty percent of a person's total body weight is comprised of water. Seventy-five percent of all Americans are chronically dehydrated. Mild dehydration, as low as three percent, will slow the body's metabolism and can contribute to weight gain. Water helps you feel full, therefore food consumption decreases. Try drinking 8-20 ounces of water before sitting down to eat each meal. You will probably find you eat less food. Always carry a water bottle as a weight loss tool.

Supervising Combat Conditioning

You may be given the task of constructing an effective workout plan for Marines under your leadership. How do you get started? First, determine the unit's conditioning goal and then go about the work to ensure your Marines will master it. Design a mission statement, and determine the stage of program that is needed to be successful in achieving the goal. There are two stages of conditioning programs: developmental and maintenance. The purposes of conditioning in the developmental stage are to develop hypertrophy (growth) and endurance, strength, and power. The second stage, maintenance, is devoted to sustaining what has been acquired through developmental conditioning.

Program Stages. Marines in the developmental stage of a combat conditioning program, require a program that develops strength, endurance, physical skills and character traits, which are beneficial to the successful accomplishment of military missions. The developmental stage should be applied progressively and rise gradually to a peak of fitness and skill.

The progressive phases of the developmental stage workouts are characterized as hypertrophy (growth) and endurance, strength and power. These progressive phases are followed by the maintenance stage.

The hypertrophy/endurance phase of the developmental stage can last from two to six weeks depending on the fitness level of the Marines being trained. The focus of combat conditioning must start with a low intensity and high volume routine. The goal during this phase is to build a muscular and cardiovascular endurance base for the future.

The strength phase lasts four to eight weeks, and will progress to more difficult and challenging tasks in the combat conditioning workouts, such as increased intervals of moderate distance and higher intensity drills. The combat conditioning becomes more specific to the goal that was already established. As the intensity increases, the volume decreases to a moderate level to ensure physical gain and reduce the chance of injury.

In the power phase, the loads are increased as well as speed work intensity. This phase can last from three to six weeks. Because the intensity is so high, it is important to monitor the recovery of Marines during this phase.

Lastly, Marines reach the maintenance stage. The human body can only progress to a certain level in a certain amount of time and this stage is used to maintain as well as recover from the developmental stage of the program. This stage is vital for the future progression of Marines. Most Marine units are in this stage and tend to remain so. Once Marines reach the commander's goal, the focus is to maintain their current physical gains by incorporating shorter bouts of combat conditioning. Three hours a week should be devoted to combat conditioning to sustain physical gains.

Time. Once the type of program needed has been established, determine the time required for each workout session. Keep in mind the types of exercises to be completed and the type of equipment to be used since this may influence the amount of time required for each exercise. Another consideration will be the number of

participants; therefore, you need to determine how the Marines should be organized to complete the exercises safely and efficiently.

Weather and Terrain. Weather is also a consideration. You should establish a backup plan that can be enacted should inclement weather force a change in location. Examine the exercise area, especially if it is outdoor terrain, and determine if it is safe for the exercise-conditioning workout scheduled.

Gear and Equipment. Determine the type of gear Marines need to wear to exercise safely. Be sure to specify the appropriate uniform to wear and any safety equipment Marines should have on hand. [**Note:** Do not forget to perform risk assessment]

Workouts. Circuit training allows Marines to receive the benefits of both cardiovascular and strength adaptations in one workout. This type of interval training may combine any one or all of the following: strength exercises, plyometric exercises, and endurance exercises. Circuit training can easily be used with large groups of Marines, is time efficient, and lends itself to Marine conditioning workouts. Modifications like repetitions, number of sets, or duration can be implemented without difficulty. Circuit training requires minimal or no equipment, facilities and space. If resistance is required, use whatever is available, such as weights, ammo cans, sand bags, or body weights (e.g., wrist, ankle or body vests). When considering circuit training as the method for a workout, decide what type of fitness will be stressed and the circuit design can then be developed. Examples of circuit training exercises and workouts are provided in the appendices.

- The following factors should be considered when designing circuits for workouts.
- The greater the fitness level of the tactical athlete, the shorter the rest period should be.
- Allow three to five minutes between sets to maintain quality work efforts in each set.
- Avoid complex lifts or exercises.
- Avoid extreme fatigue because the risk of injury rises when technique breaks down.
- Marines should be familiar and competent to perform all exercises included in the circuit.
- Olympic lifts (e.g., clean and jerk, and snatch) should never be included within a circuit. These very complex exercises are hard to do safely when fatigued.

Summary

Marines are the ultimate warriors who must be prepared for any uncertainty. To ensure this goal of preparation for uncertainty is more easily achieved, Marines must strive for an optimal fitness level at all times. A combat conditioning program combines strength, power, speed, agility, aerobic and anaerobic fitness, flexibility and agility. It is designed to mitigate the human factors experienced during combat that have a physically debilitating effect on the human body. Assuring all Marines achieve a high level of wellness and physical conditioning, requires moving beyond our current physical fitness program incorporating martial arts training, traditional physical fitness, water survival training, and rough terrain skills training. The Marines' personal combat conditioning performance helps build the foundation for their individual leadership roles within the Marine Corps. All health and wellness instruction as well as the physical exercise training Marines undertake is intended to prepare Marines for the rigors of the battlefield encountered in today's modern combat.

References

American College of Sports Medicine. (2006). *ACSM's Guidelines for Exercise Testing and Prescription* (Seventh Edition). Lippincott Williams & Wilkins.

American Journal of Public Health. (1993, September). Washington, DC: AJPH.

Baschle, T.R., & Earle, R.W. (2000). Essentials of Strength Training and Conditioning (Second Edition). Human Kinetics.

Cinea, Keith. (2007). Rest and recovery: The forgotten training component. *National Strength and Conditioning Tactical Strength and Conditioning Report*. Issue 1, 1.

Dawes, Jay. (2007). Basic training concepts for improved operational fitness. *National Strength and Conditioning Tactical Strength and Conditioning Report.* Issue 4, 1-2.

Dintiman, W & Tellez. (1998). Sports Speed: Second Edition Human Kinetics.

Hamilton, N., & Luttgens K. (2002). Kinesiology. Scientific Basis of Human Motion: Tenth Edition. McGraw Hill.

Hollenbach, KA, et al. (1999 August). *Atlas of Injuries in the U.S. Armed Forces* Supplement to Military Medicine. Washington, DC: ICEHS.

Hollenbach, K.A. et al. (1993 September). Cigarette smoking and bone mineral density in older men and women. American Journal of Public Health. 83(9): 1265-1270.

Infantolino, Greg. (2007). Power development using boxes. *National Strength and Conditioning Tactical Strength and Conditioning Report*. Issue 4, 3-4.

Military Medicine. (1999 August). *International Journal of AMSUS Atlas of Injuries in the U.S. Armed Forces* Supplement to Military Medicine. vol 164, no 8.

Moore, Paul. (2007). Sports nutrition for recovery. *National Strength and Conditioning Tactical Strength and Conditioning Report*. Issue 1, 1-3.

Nieman, D.C. (2003). Exercise Testing and Prescription, A Health-Related Approach: Fifth Edition. McGraw Hill.

PMCID: PMC1694953

Shepard, G. (2004). Bigger Faster Stronger. Human Kinetics.

Snyder, Suzie. (2007). Introduction to tactical strength and conditioning. *National Strength and Conditioning Tactical Strength and Conditioning Report*. Issue 2, 1-2.

Stephenson, Mark. (2007). The tactical athlete. *National Strength and Conditioning Tactical Strength and Conditioning Report.* Issue 1, 1.

Stephenson, Mark. (2007). Suspension Training. *National Strength and Conditioning Tactical Strength and Conditioning Report.* Issue 1, 4-7.

Tyson, A. & Cook B. (2004). Jumpmetrics. Human Kinetics.

MCO 6100.13 W/CH 1. (1 August 2008). *Marine Corps Physical Fitness Program.*

MCO 6110.3. (8 August 2008). *Marine Corps Body Composition and Military Appearance Program.*

MCO 6200.1E W/CH 1. (6 June 2002). *Marine Corps Heat Injury Prevention Program.*

Glossary of Terms and Acronyms

Word	Meaning
Adenosine triphosphate (ATP)	A phosphorylated nucleotide $C_{10}H_{16}N_5O_{13}P_3$ composed of adenosine and three phosphate groups that supplies energy for many biochemical cellular processes by undergoing enzymatic hydrolysis especially to ADP — called also *adenosine triphosphate*
Aerobic	Involving, utilizing, or increasing oxygen consumption for metabolic processes in the body <stationary bicycles used for *aerobic* conditioning>
Agonist	Muscle groups that are the prime movers
Amenorrhea	Abnormal absence or suppression of the menstrual cycle
Anaerobic	Of, relating to, or being activity in which the body incurs an oxygen debt
Anemia	A condition in which the blood is deficient in red blood cells, in hemoglobin, or in total volume
Frontal plane	A plane parallel to the long axis of the body and perpendicular to the sagittal plane that separates the body into front and back portions
Glycolytic energy system	This system uses a series of chemical reactions to break down glucose into a compound known as pyruvate**;** also called the lactic acid system
Hypermobile	A joint that stretches farther than is normal
Hypomobile	A joint that is capable of a smaller range or frequency of movement than normal
Hypotension	Abnormally low blood pressure
Mesocycle	Part a training program that lasts between one and three months
Microcycle	Phase of training of around one week in duration
Orthotic	A device (as a brace or splint) for supporting, immobilizing, or treating muscles, joints, or

	skeletal parts which are weak, ineffective, deformed, or injured
Oxidative energy system	This system uses stored body fat and oxygen to burn excess fat during exercise when the intensity level is low enough; the intensity level of the exercise should be between 60 and 70 percent of the maximum heart rate range
Periodization	An organized approach to training that involves progressive sequences in a training program during a specific period of time
Phosphocreatine (PCr)	A compound $C_4H_{10}N_3O_5P$ of creatine and phosphoric acid that is found especially in vertebrate muscle where it is an energy source for muscle contraction
Plyometrics	Exercise involving repeated rapid stretching and contracting of muscles (as by jumping and rebounding) to increase muscle power
Proprioception	The reception of stimuli produced within the organism
Sagittal Plane	Of, relating to, situated in, or being the median plane of the body or any plane parallel to it
Synergists	Muscles that assist the prime movers
Transverse plane	Made at right angles to the long axis of the body

Appendix A: Example Exercises

LOWER BODY		
With Barbell		
Back squat	**Lunges**: *Alt. walking*	Pitcher squat
Belt squat	*Diagonal*	Push press
Dead lift	*Forward*	Romanian dead lift
Dumbbell squat	*Lateral*	Single leg squat
Explosive calf raises	*Overhead*	Split squat
Front squat	*Reverse*	SB wall squat
Good mornings	*Wheel*	Staggered squat
Lateral squat	Overhead squat	Sumo squat
With Dumbbell		
Front squat	Pitcher squat	Stiff-legged dead lift
Lateral lunge	Romanian dead lift	Split squat
Lunges	Single leg squat	Sumo squat
Lateral squat	Sitting calf raises	
Other		
Glute Ham raise	Leg curl: MB	Partner glute/ham raise
Hip abductor: cables/floor	Leg curl: SB	SB/bench hip lift
Hip adductor: cables/floor	Leg curl: standing	SB hip hike
Hip extension: cable	Lunge w/ press	Squat hold w/out weight
Hip flexion: cable	Lunge w/ twist	Wall sit w/ & w/out weight

UPPER BODY		
ARMS	**BACK**	**SHOULDERS**
Bicep curl	BB Bent-over row	Arnold press
Forearm curl	Chin-ups	Bent arm raise
Hammer curl	DB Bent-over row	DB shoulder press
Reverse curl	Pull down	Front press
Skull crusher	Pull over	Front raise
Tricep bench dips	Pull-up	Lateral raise
Tricep extension	Scorpions (cable)	Military press
Tricep kickback	Seated row	Overhead press
	Shrugs	Push press
	Straight arm Lat. pull down	Reverse fly
DUMBBELL	Upright row	Shrugs
Flat bench		Straight arm plate rotation
Flat bench fly	**OTHER**	**CHEST**
Incline bench	Cable fly	Bench press
Incline bench fly	Cable scoops	Close grip bench press
Pull over	Dips	Decline press
Push-ups	Push-ups	Incline press
Push-ups with row	Unstable surface push-ups	

CORE EXERCISES—WITH EQUIPMENT		
Ab wheel	Hanging gorilla	SB ab roll out
Cable crunch	Hanging leg lower/knee raises	SB crunch
Cable twists/chops	MB circuit	SB knee tucks: oblique
Decline sit-up w/MB toss	MB plyo pullover	SB knee tucks, straight
Decline sit-up w/oblique toss	Off-bench oblique	SB kneeling balance
Diagonal plate chops	Sitting plate/MB twist	SB Russian twist
Figure 8s	Standing barbell twist	Woodchoppers
LOWER BACK		
Back extension	Hyper hold	Suspended superman
Back extension w/twist	Reverse hyper	

CORE EXERCISES—NO EQUIPMENT		
90/90 crunches	Leg lowers, alternating	Plank holds
100s	Leg lowers, decline bench	Toe touches
Dead bug	Leg lowers, floor	V-ups
Draw-ins	Leg lowers, off-bench	V-ups, short
Flutter kicks	Oblique bridge dips	V-ups, side-lying
Half-dead bug	Oblique heel touches	Windmills
Hip-ups		
LOWER BACK		
Lying back extension	Quadrupeds	Superman
Lying back extension w/twist	Scorpions	Swimmers
Lying opposites		

PLYOMETRICS		
Box jump	MB rotational toss	Scissor jumps
Burpees	MB scoop toss, overhead	Skater jumps
Dot drills	MB scoop toss, underhand	Split jumps
Explosive box step ups	MB slams	Squat jumps
Hurdle hops & jumps	Pike jumps	Star jumps
Lateral lunge thrust	Plyo pullovers	Tuck jumps
Line jumps & hops	Prisoner squat jumps	Vertical jumps
Long jumps	Quadrants	XC Skier jumps
MB chest pass & sprint		
Plyometric—Olympic Lifts		
Clean & jerk	Snatch (Power jerk)	DB snatch/clean

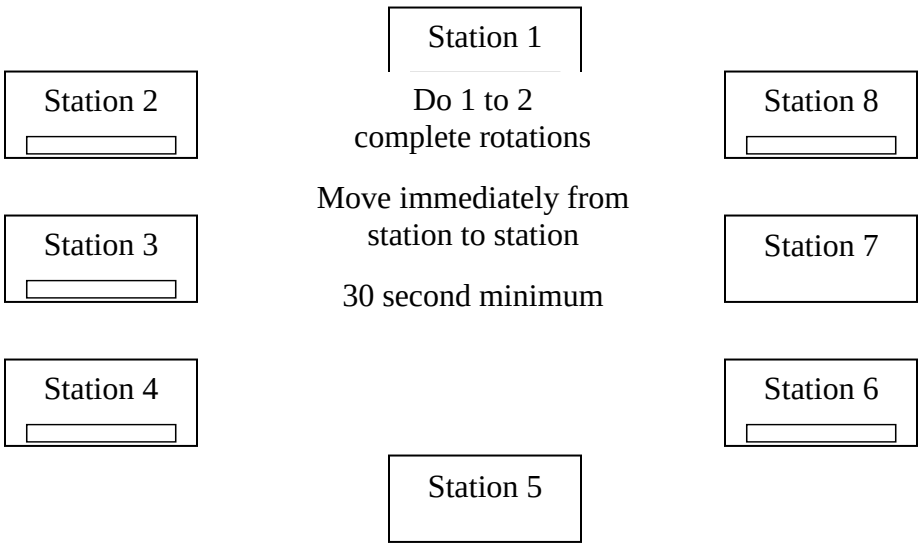
PREHAB/REHAB EXERCISES		
ROTATOR CUFF / SCAPULAR		
Clock walks	Internal rotation	Scarecrow
D1/D2	MB wall dribble	Shoulder burn circuit
Empty can	Rotational push-up reaches	Y, T, W, L
External rotation	Scapula push-up	
ANKLE PREHAB		
Bongo board balance	Theraband alphabet	Theraband internal
Dynadisk/airex/foam roller bal.	Theraband external	Toe/heel taps
KNEE REHAB/PREHAB		
¼ Squat	Box jump ups	Lateral TKE
Anterior lunge reach	Box jump offs	

Appendix B: Example Workout

Sample Circuit Template
1-3 sets
8 -15 separate exercises
Alternate between upper body, lower body, speed, agility, power
Work period = 30 - 60 seconds
Rest period = 20 – 60 seconds

Traditional Circuit Example 3 Sets of Each Exercise, 20 Reps Each - Continuous
Lunges-front/side
Abdominal crunches
Mountain climbers
Oblique crunches
Six-count bodybuilders
Back extensions
Push-ups

Strength/Cardio Circuit Example - 1 Minute per Station	
Squat jumps	Lateral squats
Jump rope	Flutter kicks
Monkey squats	Harness pull
Jumping jacks	Human T-bar
Steam engines	8-count bodybuilders
Dive bombers	Hurdles over rifles
Run around helmets	Flutter kicks-prone
Push-ups	Dips



Agility and Core Circuit Example		
Station	**Exercise Example**	**Time**
Dynamic Warm-up	Easy Jog	5
Agility	Forwards/Backwards Jog	2
Core	V-Ups	1
Agility	Side Shuttle	2
Core	Side Plank	1
Agility	Speed Skaters	2
Core	Back Extension	1
Agility	M-Drill	2

Workout Template							
	Sunday	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**
Dynamic Warm-up	Rest	X	X	X	X	X	Rest
Muscular Strength or Endurance	Rest	Rest	X	Rest	X	Rest	Rest
Speed/Agility	Rest	X	Rest	Rest	Rest	X	Rest
Plyometrics	Rest	X	Rest	Rest	Rest	X	Rest
Cardio	Rest	X	Rest	X	Rest	X	Rest
Core	Rest	X	X	X	X	X	Rest
Cool Down/ Flexibility	Rest	X	X	X	X	X	Rest

Appendix C: Example Exercise Cards

Dynamic Warm Up

- Jog (forward/backward)
- Forward lunge
- Side lunge
- Reverse lunge
- Leg cradle
- Frankenstein
- High knees
- Skip (height/distance)
- Spiderman
- 50% sprint/75% sprint
- Knee hugs
- Inch worm
- Lunge with twist/reach
- Monster walk
- Butt kicker
- Carioca
- Side-straddle hop
- Back peddle
- Side shuffle (L/R)
- Crab walk
- Bear crawl

Muscular Strength and Endurance

- Ammo can squat
- Ammo can dead lift
- Single leg ammo can dead lift
- Ammo can overhead press
- Ammo can woodchoppers
- Single leg squat
- Speed skater lunge
- Walking lunge-pack front hold
- Pack squat
- Push-ups
- Pack push-up
- Pack curl
- Buddy shoulder press
- Buddy row
- Buddy dip
- Fireman carry - 50 yards

Speed/Agility

- 60-yard shuttle run
- Prone T-drill
- Single leg hurdle jump-all directions
- 50-yard ammo can sprint
- Agility ladder
  - 1 in, 1 out
  - 2 in, 2 out
- M-drill
- 60-yard forward/backward shuttle
- Carioca
- Pro agility drill
- Zigzag casualty drag
- Backward skipping-20 yards
- X-drill
- Box drill
- Goalie drill
- Attack and retreat
- 150-yard shuttle
- Hour glass drill
- 20-yard cone weave drill
- Chaos drill
- Vertical jump and go
- Push-up and go
- J Hook reverse sprint
- Combat glide shuffle
- Tall and fall
- Partner-resisted sprints

Plyometrics

- Prisoner squat jump
- Split squat jump
- Box jump
- Clap push-up
- Burpees
- Bounding
- Forward/backward hurdle jump
- Standing long jump
- T push-up
- Tuck jump
- Star jump
- Traveling push-up
- Hurdle jumps (side-to-side)
- Vertical jump
- Eight-count body builder

Core Workout

- V-up
- Flutter kick
- Oblique crunches
- Mountain climbers
- Dead bug
- Plank
- Side plank
- Rope climb
- Crunches
- Bicycle crunches
- Swimmers

Martial Arts Routines

The below routines are single integration exercise or can be combined to conduct a cardio circuit.

- Punches single / combinations
- Standing /ground elbows
- Upper body strikes
- Standing /ground knees
- Lower body strikes
- Spin drills
- Over and under
- Pummeling
- Monkey rolls variation
- Take down drill single and double leg
- Shrimping
- Stand Up and base drill
- Buddy drills
- Bayonet drills
- Combat conditioning drills LZ
- Fartlek run
- Obstacle course
- Tactical measure drills

Cardio

- Hill run
- CAS EVAC
- Obstacle course
- K.E.M.S. run
- Individual/ability run
- Last Marine up run
- Run/swim/run
- Spartan run
- 20 & 20 run
- Fartlek
- Martial arts cardio interval training

Cool Down/Flexibility

- Neck pull
- Overhead tricep
- Back shoulder
- Chest opener
- Lateral bend
- Cat/dog
- IT band
- Modified hurdler's stretch
- Standing, side-lying quad
- Pigeon
- Modified cobra
- Standing, lying hamstring

Notes