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NUTRITION FOR HEALTH AND PERFORMANCE, 2001

Nutritional Guidance for Military Operations in Temperate and Extreme Environments

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FOREWORD

This technical note is an update of USARIEM Technical Note 93-3, dated Feb 1993, originally authored by C. D. Thomas, C. J. Baker-Fulco, T. E. Jones, N. King, D. A. Jezior, B. N. Fairbrother, and E. W. Askew. This technical note updates the information on operational rations and includes water intake guidelines for training school environments based on current scientific data. This document also reinforces the importance of garrison nutrition by moving the Dietary Guidelines information from the appendices to an early chapter and expanding on the explanation of the Food Guide Pyramid. New material contains nutritional advice concerning supplement intake. This update to the 1993 Technical Note was drafted prior to the publication of the revised AR 40-25, which replaces Military Recommended Dietary Allowances with Military Dietary Reference Intakes and changes many of the ration standards. Footnotes were added where indicated to acknowledge the changes that are expected in the regulation.

This document is not intended to replace policy or doctrine established by Headquarters, Department of the Army, Training and Doctrine Command, Forces Command, AR 40-25, and other official publications. Rather, the information is integrated from a variety of sources to include studies conducted by the United States Army Research Institute of Environmental Medicine (USARIEM); observations made by Institute personnel in garrison and field environments; and information extracted from nutrition-related manuals, circulars, and bulletins. Readers are encouraged to provide critical comments and examples of their own "lessons learned" about field feeding for military personnel to:

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SYMBOLS, ABBREVIATIONS, AND ACRONYMS

AMS	Acute Mountain Sickness
°C	degree Centigrade
°F	degree Fahrenheit
B	Designation for a cook-prepared ration which does not use perishable foods
FDA	Food and Drug Administration
FRH	Flameless Ration Heater
GI	Gastrointestinal
GP-I	Food Packet, Survival, General Purpose, Improved
kcal	kilocalorie
lb	pound
i.e.	id est, that is
LRP	Food Packet, Long Range Patrol
MCW/LRP	Meal, Cold Weather/Food Packet, Long Range Patrol
MDRI	Military Dietary Reference Intake
min	minute
mph	miles per hour
MRDA	Military Recommended Dietary Allowance
MRE	Meal, Ready-to-Eat
NL	No Limit
NSOR	Nutritional Standards for Operational and Restricted Rations
RCW	Ration, Cold Weather
RDA	Recommended Dietary Allowance
SBCCOM	Soldier and Biological Chemical Command
SSC	Soldier Systems Center
T-Ration	Tray Pack Ration
UGR	Unitized Group Ration
UGR-A	Unitized Group Ration, A version (contains perishable foods)
UGR-H&S	Unitized Group Ration-Heat & Serve
USARIEM	U.S. Army Research Institute of Environmental Medicine
USDA	U. S. Department of Agriculture
VMRE	Meal, Ready-to-Eat, Vegetarian
WBGT	Wet-Bulb Globe Temperature

INTRODUCTION

Nutrition should be thought of as an enhancement to military operations. Properly planned and executed, good feeding practices in the field maintain and enhance operational performance and morale and significantly contribute to mission accomplishment. Military personnel who optimize their nutritional status will better endure the harsh environments encountered in today's battlefield.

Military leaders must insure that all service members (soldiers, sailors, airmen and marines; hereafter referred to as soldiers) know the importance of food and how to implement sound nutritional practices in garrison and in the field. In addition, leaders should set the example for their troops by practicing good eating habits themselves.

This technical note provides guidance for proper nutrition in garrison and, especially, field environments. Soldiers performing physically demanding training or field missions are especially receptive to information on diet and physical performance. This technical note is written for anyone (including commanders, small unit leaders and the individual soldier) who has questions or concerns or needs information on military rations. The first chapter presents general guidelines for the garrison environment. The next two chapters present general information and suggestions for planning nutritional support of military personnel operating in any field setting. The fourth chapter addresses the issue of supplements. The latter three chapters contain special advice for operating in extreme environments, ranging from the severe heat of the desert or tropics to the bitter arctic cold and to the high altitudes of the mountains.

GARRISON ENVIRONMENT

Eating well in garrison prepares the body to be healthy and physically fit to endure any condition encountered in the field. The goal in garrison is to optimize nutritional status so the soldier will be in the best shape possible to meet the physical and mental demands of training. Keeping a soldier "fit to win" involves providing sound nutrition information and healthy food alternatives.

NUTRITION INITIATIVES

- Heighten military personnel awareness of the importance of nutrition.
- Educate military personnel to make appropriate food choices.
- Provide a variety of nutritious food alternatives in dining facilities, concessions, and commissaries.

DIETARY GUIDELINES FOR AMERICANS

Making informed food choices helps ensure obtaining the body's requirements for nutrients. The Dietary Guidelines for Americans, published by the U.S. Department of Agriculture and the U.S. Department of Health and Human Services, provides guidance on what to do for good health. The dietitian at the installation hospital or in the local community can provide detailed information and assistance on implementing the various guidelines.

Aim For Fitness…

- ***Aim for a healthy weight.*** For individuals at a healthy weight, the aim is to avoid weight gain. For persons above their healthy body weight, moderately decreasing calorie intake and increasing exercise will help. A steady weight loss of ½ to 2 pounds per week is usually safe. The diet should consist of a healthful assortment of foods that includes vegetables, fruits, grains, (especially whole grains), skim milk, and fish, lean meat, poultry, or beans. Foods that are low in fat and added sugars should be chosen most of the time. Whatever the food, the portion size should be sensible.

- ***Be physically active each day.*** The aim is to accumulate *at least* 30 minutes of moderate physical activity daily. Individuals who already get 30 minutes of physical activity daily gain even more health benefits by increasing the amount of time they are physically active or taking part in more vigorous activity.

In other words, the goal is a lifestyle that combines sensible eating with regular physical activity.

Build a Healthy Base…

- **Let the Food Guide Pyramid guide your food choices.** Different foods contain different nutrients and other healthful substances. No single food contains all nutrients in the amounts needed for health. One way to build a healthy diet is to choose foods each day from the major food groups depicted in the Food Guide Pyramid (see page 6). Individuals who avoid all foods from any of the five food groups should seek guidance from a dietitian to ensure they get all nutrients needed.
- **Choose a variety of grains daily, especially whole grains.** Foods made from grains (like rice, pasta, tortillas, cereals, or breads) are the foundation of a nutritious diet. They provide complex carbohydrates, dietary fiber, vitamins, minerals, and other food components linked to good health. Whole grains have more fiber, nutrients, and other protective substances than do refined grain products. Grain products are low in fat—unless fat is added in processing, in cooking, or at the table.
- **Choose a variety of fruits and vegetables daily.** Fruits and vegetables are key foods in the daily diet, providing essential vitamins, minerals, fiber, and other substances important for good health. Eating plenty of fruits and vegetables makes it easier to avoid getting too many calories. Dark-green leafy vegetables, bright orange fruits and vegetables, and cooked dried peas and beans should be chosen often.

- **Keep food safe to eat.** Eating even a small portion of an unsafe food can make someone sick. Perishable foods that require special care include foods containing eggs, meats, poultry, fish, shellfish, or milk products. To keep foods safe:

  ❑ **Clean**: Wash hands and surfaces often. Wash hands before and after preparing food, especially after handling raw meat, poultry, fish, shellfish, or eggs. Wash raw fruits and vegetables with warm water before eating.

  ❑ **Separate**: Separate raw, cooked, and ready-to-eat foods while shopping, preparing, or storing. Store raw foods in a container in the refrigerator so that the juices don't drip onto other foods.

  ❑ **Cook**: Cook food to a safe temperature. Proper cooking makes most uncooked foods safe. The best way to tell is to use a thermometer. Reheat sauces, soups, marinades, and gravies to a rolling boil. Reheat leftovers thoroughly to at least 165° F, and reheat them only once. Don't eat raw or partially cooked eggs or foods made with them.

  ❑ **Chill.** Refrigerate perishable foods promptly. Refrigerate foods within 2 hours of purchasing or cooking—within 1 hour if the air temperature is above 90° F. Use refrigerated leftovers within 3 to 4 days. Freeze fresh meat, poultry, fish, and shellfish that cannot be used in a few days—never thaw at room temperature.

  ❑ **Follow the label.** Follow the safe handling instructions on the package, such as "Keep refrigerated."

  ❑ **Serve safely.** Keep hot foods hot (above 140°F) and cold foods cold (below 40°F). Chill leftovers as soon as people are finished eating. Whether raw or cooked, never leave meat, poultry, eggs, fish, or shellfish out at room temperature for more than 2 hours (1 hour in hot weather).

  ❑ **If in doubt, throw it out.** Even if a food looks and smells fine, it may not be safe to eat.

Choose Sensibly…

- **Choose a diet that is low in saturated fat and cholesterol and moderate in total fat.** In general: 1) Eat plenty of vegetables, fruits, and grain products; 2) Choose lean meats, fish, or poultry (without skin); 3) Choose dried beans, peas, or lentils often; 4) Choose low-fat dairy products; 5) Choose vegetable oils rather than solid fats (meat and dairy fats and shortening); and 6) Use fats and oils sparingly.

- **Choose beverages and foods that limit your intake of sugars.** Foods that are high in added sugars are often high in calories but low in essential nutrients. Take care not to let soft drinks or other sweets crowd out other foods needed to maintain health (such as milk or other good sources of calcium) or contribute unneeded calories. Eating or drinking sweet (or starchy) foods between meals is more likely to harm teeth than eating the same foods at meals and then brushing. Rinsing the mouth with water after between meal snacks can reduce the risk of tooth decay.

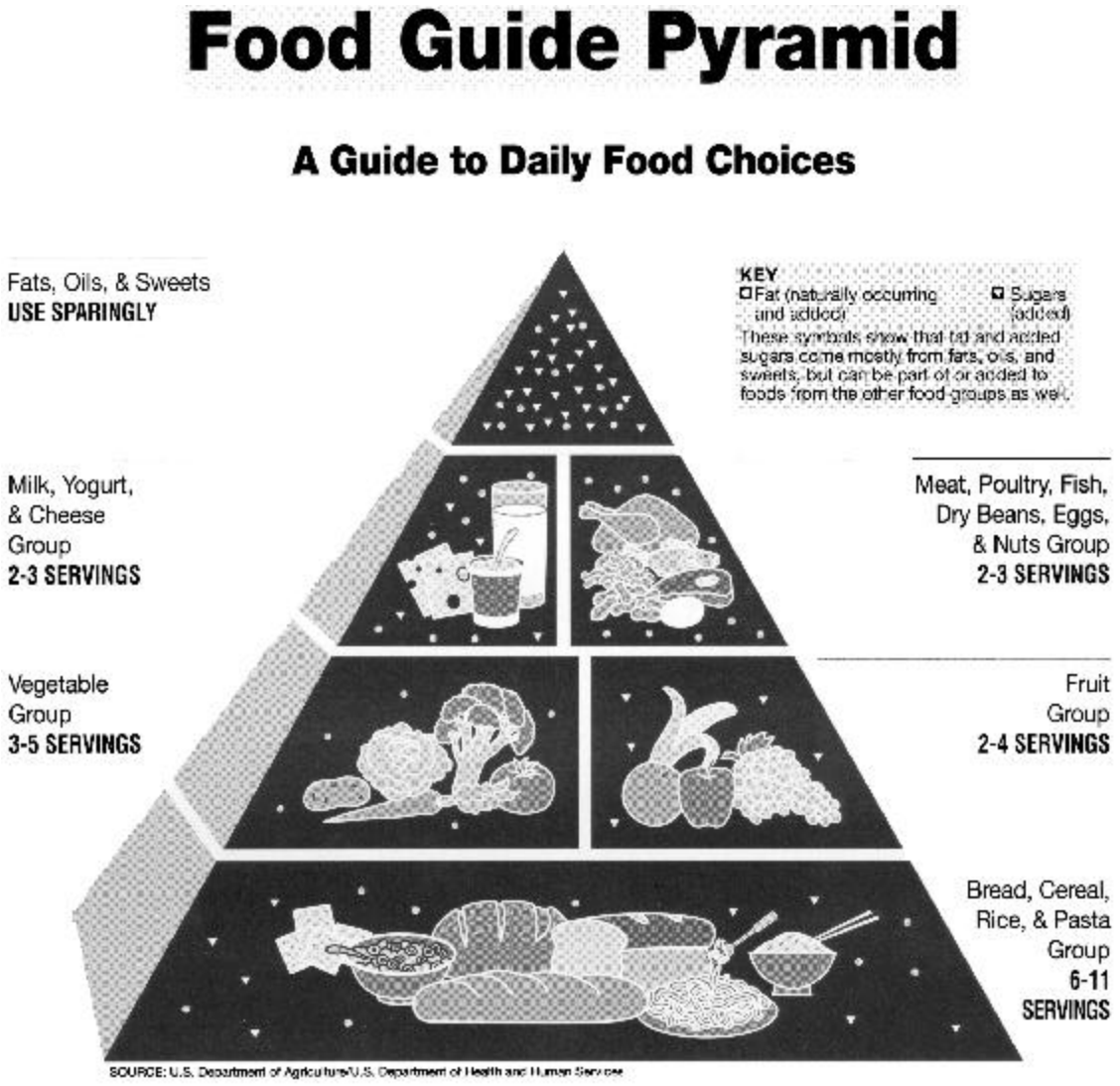
- **Choose and Prepare Foods with Less Salt.** Table salt is made of sodium and chloride. Salt is found mainly in processed and prepared foods. Sodium helps our body maintain proper fluid balance, but too much sodium increase blood pressure. Reducing salt and sodium intake may help lower blood pressure in people who have high blood pressure and may help prevent others from developing high blood pressure. Limit salt added to foods and the consumption of processed, high-sodium foods (read food labels). Use herbs, spices, and fruits to flavor food.

- **If You Drink Alcoholic Beverages, Do So in Moderation**. Alcoholic beverages supply calories but few nutrients. Moderate drinking may be beneficial for cardiovascular health (mostly in older men and women), but drinking is also linked with many health problems. It also is the cause of many accidents and can lead to addiction. Heavy drinkers are often malnourished because of low food intake and poor absorption of nutrients by the body. Alcohol should be limited to one drink/day for women or two drinks/day for men and should be taken with meals to slow the absorption of the alcohol. One drink is 12 ounces of regular beer, 5 ounces of wine, or 1.5 ounces of 80-proof distilled liquor.

THE FOOD GUIDE PYRAMID

A guide to follow to meet the dietary guidelines and consume a healthy diet is the Food Guide Pyramid (Figure 1). The Pyramid illustrates the food groups and how much to eat from each food group to get the required nutrients and stay within the Dietary Guidelines.

Figure 1.



At the base of the Pyramid is the **bread, cereal, rice and pasta group**: this is the largest part of the Pyramid. It is recommended that you consume a minimum of 6-11 servings per day from this group. When you are actively training, you may need many more servings than this. Your calorie needs for activity will serve as your guide.

As you move up the Pyramid, the next section is the **vegetable group**. It is recommended that you consume a minimum of 3-5 servings per day. It is important to make wise choices from this group and include deep yellow and dark green vegetables that are high in vitamin A and beta-carotene.

On the same level as the vegetable group is the **fruit group**. One should aim to consume 2-4 servings minimally each day. A fruit or juice that is high in vitamin C, like oranges or orange juice should be included daily. As with all the food groups in the Pyramid, your calorie needs will guide the number of servings you eat.

Moving up the Pyramid, the next group you see is the **dairy group**. It is recommended that women, throughout their life span, consume a minimum of 2-3 servings per day from this group to obtain adequate calcium to prevent osteoporosis. A minimum of 2-3 servings is also recommended for men. Foods in the dairy group are the major sources of calcium in the American diet, so it is important to consume adequate amounts from this group. If a person is intolerant of milk, cheese and yogurt can often be substituted. Another option is to drink milk that has been modified to reduce lactose. Whatever dairy product is chosen, it is important to make sure that it is low-fat or fat-free to lower the saturated fat content of the diet.

Next to dairy products is the **meat group**, which contains meat, poultry, fish, dry beans, eggs, and nuts. As for dairy products, it is recommended that you consume 2-3 small servings per day from the meat group. Americans tend to eat larger portions of meat than is needed for adequate protein intake. Because animal products can provide significant amounts of fats—particularly saturated fats—the focus should be on consuming foods of a lower fat nature: poultry without the skin, lean cuts of beef and pork, and fish. Items should be broiled, baked, or roasted rather than fried.

Finally, at the tip of the Pyramid are the **fats, oils, and sweets**. These are foods such as salad dressings, cream, butter, margarine, soft drinks, candies, and sweet desserts. Alcoholic beverages also belong in this group. These foods can be very high in calories and often have little or no nutritional value.

You should consume a variety of foods from each of the five major food groups. Let your activity level guide the number of servings you choose from each group.

Information on specific nutrients and their food sources may be found in Appendix A.

NUTRITIONAL SUPPLEMENTS

Nutritional or dietary supplements—ranging from essential nutrients to herbal remedies and sports products—have mushroomed in popularity. Besides the traditional preparations designed to correct or prevent nutrient deficiencies or reduce the risk of chronic diseases, there is a growing list of ergogenic products (substances that promise to boost physical performance) to tempt both weekend and professional warriors. Some soldiers may take supplements because they believe they cannot or do not consume enough food to meet their nutritional needs. Or they may believe supplements provide extra nutrients or give a performance advantage that food alone cannot provide. Other soldiers may be looking to improve their ability to meet the challenges of field training and harsh environments.

Although some persons may need or benefit from dietary supplements in some situations or at certain times, the routine use of supplements is not worthwhile for most soldiers. Garrison meals and operational rations can provide for the needs of most soldiers in almost all of the situations they encounter. The best nutritional strategy for promoting optimal health and performance is to ensure adequate consumption of rations and fluids. In addition, although a few supplements may possess qualitites that might enhance health status or sport performance, many, if not most, do not live up to their marketing hype.

Supplements are not regulated as drugs, and, thus, do not fall under the same strict formulation and production guidelines as drugs. Manufacturers of dietary supplements do not have to prove they are safe and effective before putting them on the market. Also, those who benefit from their sales often distort or exaggerate the research findings or overlook negative effects. There is very little research on the safety of taking even beneficial supplements for a long time. In addition, the effect of simultaneously taking multiple supplements is unknown, as is the effect of taking supplements in very hot or very cold climates. Also unknown is the highest safe level of intake for many supplements. Vitamins A and D, iron, zinc, and selenium are especially toxic in high doses, while large amounts of vitamin B_6, niacin, and many other nutrients have harmful side effects.

Herbal products are particularly risky. The active substances in herbs are fundamentally drugs, but, unlike drugs, they are not purified nor are the levels of the active compounds standardized. Many herbal products have caused allergic reactions in certain individuals; others have caused liver damage, high blood pressure, irregular heart beats, or death.

For these reasons, soldiers should carefully evaluate any supplement they may be thinking about taking and determine if there are any potential problems with their intake. There are several factors that individuals need to consider when evaluating the claims for a supplement.

1. Does the supplement's claim make sense? Are potential side effects as well as benefits listed? Is there good evidence from an unbiased source it really works? (Salespeople and advertising are not reliable sources of information.)

2. Is the claim made by a source known to be truthful?

3. Has the supplement been evaluated in well-controlled research studies and have the findings been corroborated?

4. Has information on the supplement's effects been published in scientific journals and are references provided? Is the claim based on more than bold headlines based on a single study?

5. Is there information on the effects of taking more than one supplement at a time? Is there information on the effects of taking the supplement when taking any medications?

6. Have the Food and Drug Administration or the state department of health issued any advisories on this supplement?

Determining whether a supplement is appropriate or potentially beneficial under field conditions is even more complicated. While supplements may have undergone studies in the laboratory, little if any information may be available about the effects of a supplement when taken in severe environments or under conditions of fatigue or dehydration—conditions that are often encountered in training or on the battlefield.

Table 1. Supplements and Claimed Effects

Supplement	Available Form	Manufacturers' Claims*	Side Effects
Amino Acids	Powders, tablets, liquid; Adequate amounts of individual amino acids may be obtained in a diet consistent with the Food Guide Pyramid.	Enhances muscle formation by increasing the release of growth hormone; changes hormonal responses to enhance recovery after high-intensity exercise; delays fatigue (*questionable benefit)*	Nutritional imbalances; diarrhea; Prolonged use over a decade or more may lead to calcium deficiencies/osteoporosis; High amounts may increase health risk for those with liver or kidney ailments
Amphetamines	Tablets or powders	Stimulates central nervous system; increases blood flow to and contractility of muscle, increases time to exhaustion (*illegal unless prescribed by a physician)*	Large doses can produce mental confusion, hallucinations, dependency, and brain damage; lower doses can produce headache, anxiety, and sleeplessness; cardiorespiratory effects include high blood pressure, irregular heartbeat, convulsions, and death; There are reported cases of lethal heat stroke during prolonged heavy exertion.
Androstenedione	Pill	Used by the body to manufacture estrogen and testosterone, which regulates the growth and repair of muscles resulting in gains in muscle mass and strength *(conflicting data)*	Increased risk of heart attack; may stunt growth in young people; may alter secondary sexual characteristics; limited information regarding the extent to which it increases muscle mass
Antioxidants	Tablets, sports bars, sports drinks, vitamin C, vitamin E, beta-carotene; found in fruits and vegetables	Reduces oxidative damage to reduce muscle soreness caused by unaccustomed strenuous aerobic exercise, thereby helping recovery; prevents muscle breakdown associated with eccentric exercise; Improves physical power *(More research needed)*	High doses can cause nausea, abdominal pain, diarrhea, peripheral nerve impairment, fatigue (selenium); headache, fatigue, diarrhea (vitamin E); diarrhea, kidney stones, and other side effects (vitamin C); yellow skin (beta-carotene)
Caffeine	Pills such as NoDoz, Vivarin, and Ripped Fuel; found in coffee, tea, and chocolate and guarana and kola nuts	Increases alertness by stimulating the central nervous system; excites muscle contractions; lowers perceived exertion; increases free fatty acid mobilization; spares muscle glycogen	*In high doses*, increased nervousness, insomnia, stomach and intestinal distress, increased urine formation, tremors, anxiety; heart palpitations, convulsions; may impair the potential ergogenic effect of creatine.
Carbohydrates	Liquids (sports drinks), gels, sports bars, glucose tablets	Provides energy for activity, especially aerobic endurance activity; enhances intermittent, high-intensity, anaerobic exercise; accelerates recovery after exercise *(benefits proven)*	Large doses of concentrated simple carbohydrates *(i.e., sugars, especially fructose)* can cause diarrhea
Carnitine	Powders, pills; found in meat & milk products	Corrects carnitine deficiency in the body thereby improving physical performance by increasing power and endurance *(no benefit)*	Little data on long term safety; diarrhea occurs in doses larger than 2 to 6 grams/day

***With the exceptions of carbohydrate and caffeine, and possibly creatine, the effectiveness of other substances as ergogenic aids has not been irrefutably proven. The possible harmful side effects outweigh any small potential benefit as performance enhancers.**

Table 1. Supplements and Claimed Effects

Supplement	Available Form	Manufacturers' Claims*	Side Effects
Choline	Powder, pills; found in nuts, wheat germ, cauliflower, spinach, soybeans and the lecithin in egg yolks and organ meats	Increases physical power by maintaining optimum acetylcholine levels for its function as a neurotransmitter *(no proven benefits)*	Nausea, bloating, diarrhea
Chromium picolinate	Tablets; found in brewer's yeast, asparagus, mushrooms, cheese, nuts, and whole-grain products	Enhances muscle mass and decreases body fat through improved insulin sensitivity which may improve storage of muscle and liver glycogen, thereby improving use of glucose during aerobic endurance events *(no proof to support benefits)*	Excessive intake may be be toxic to the kidney or cause cancer
Creatine	Powders, pills; found in red meats & produced by the body	May stimulate energy production, increase strength, power and muscle size when combined with resistance exercises. Creatine may help the body produce energy for quick bursts of power *(claimed benefits likely valid)*	Cramping, muscle tears, stomach and intestinal distress; may cause water retention, lead to kidney problems, seizures; impact of long term use is unknown
Ephedrine	Pill, tablet, or by inhaler; Ma Huang	Stimulant to promote weight loss; Enhances performance factors that may benefit from stimulation of the ATP-CP, lactic acid and oxygen energy systems *(very risky)*	Over-stimulation of the central nervous system, vomiting, shortness of breath, irregular heartbeat, seizures, death
Ginseng	Capsules and liquids	Increases oxygen consumption leading to increased energy production and decreased time to fatigue; Resistance to stress *(no proven benefits; preliminary evidence may prevent acute mountain sickness*)	May cause diarrhea, skin rash, insomnia, nervousness high blood pressure, abnormal accumulations of body fluid, euphoria
Growth Hormone	By injection	Stimulates growth of muscles; enhances fat oxidation and metabolism of carbohydrate	May cause pathologic enlargement of the face, hands, and feet, as well as body organs (such as the liver and heart) weakening them and predisposing them to chronic diseases
Protein	Powders, drinks (such as GatorPro, NitroFuel); found in meat, milk, and many other foods. Adequate amounts of protein may easily be obtained from a normal diet.	May decrease muscle breakdown, enhance tissue formation, and accelerate recovery from training	Prolonged use over a decade or more may lead to calcium deficiencies/osteoporosis; quantities in excess of RDA may increase health risk for those with liver or kidney ailments
Yohimbe	Tablet, capsule, or liquid extract	Increases muscle mass and decrease body fat *(no benefits)*	Side effects include dizziness, nervousness, headache mild tremors, nausea; no long term studies to document effectiveness

***With the exceptions of carbohydrate and caffeine, and possibly creatine, the effectiveness of other substances as ergogenic aids has not been irrefutably proven. The possible harmful side effects outweigh any small potential benefit as performance enhancers.**

MILITARY RATIONS

The cornerstone of field feeding is the military ration. A ration is defined as one day's supply of food. Operational rations include General Purpose Rations (which include group and individual rations), Survival Rations, and Special Purpose Subsistence Rations (e.g., Humanitarian Rations) The type of ration provided to soldiers is based upon the unit's mission, tactical scenario, location, and availability of food service equipment and personnel. This chapter provides an overview of how rations are developed and brief descriptions of the rations and their nutritional content.

RATION DESIGN AND DEVELOPMENT

In response to service requirements specified by combat developers and planners in the Army, Navy, and Air Force, food technologists at the Soldier and Biological Chemical Command (SBCCOM), Natick Soldier Systems Center (SSC) design military rations and develop ration prototypes. The food technologists also work with medical research personnel from the U.S. Army Research Institute of Environmental Medicine (USARIEM) and behavioral scientists from the Supporting Science Directorate, SSC, to conduct extensive ration evaluation and testing during field training exercises to determine nutritional adequacy and soldier acceptability of rations. Based on feedback and recommendations from military personnel, rations are continuously updated and improved.

Commercial contractors manufacture approved ration items for the military. Rations are made from "real foods" (commercially grown and processed). Commercial brand name foods and military ration items are often very similar. In most cases, the manufacturers prepare the actual food product just as they would for commercial items, but package the food for military rations in special packaging. The military packaging provides longer shelf life for the foods and frequently makes them more compact or lightweight for ease of carrying.

RATION DESCRIPTIONS

General Purpose Rations

General Purpose Rations include both group rations and individual rations. **Group Rations** are best used when units are located in more stable or uncontested regions on the battlefield or area of operations and there is an opportunity for a group of soldiers to eat together as a unit. These meals require more time and resources to prepare and serve and depend upon the logistical capability to deliver all components. Prepared and served hot to the soldiers, the meals are often referred to as "hot meals." **Individual Rations** are best used when the levels of combat are intense or unit activity precludes the use of a prepared group ration. Soldiers conducting combat operations (attack, raids, ambushes) in fighting positions or widely dispersed at remote sites represent examples of the right time and place for using the individual ration.

Combining Group Rations and Individual Rations allows the commander to support different battlefield situations. Under current field feeding policy, soldiers in the field should receive three quality meals each day with at least one cook-prepared meal per day, METT-T* dependent. The remaining two meals would be provided from other group and individual rations. A restricted ration (e.g., the Food Packet, Long Range Patrol (LRP) may be needed under certain operational scenarios, such as long-range patrol, assault, reconnaissance, or when resupply is unavailable. A restricted ration should not be consumed for more than ten consecutive days to avoid prolonged sub-optimal nutrient intake and excessive weight loss.

Group Rations

The **Unitized Group Ration (UGR)** is designed to simplify and streamline the process of providing group meals in the field by integrating components of A-Rations and Heat & Serve (H&S) Rations (formerly called Tray Rations or T Rations) with quick-prepared, brand name commercial products. This ration is available in two options with each sharing a core of quickly prepared and/or ready to use commercial products. The ration comes in three boxes and is designed to provide 50 meals. All components for a complete 50-person meal are included in the UGR, with the exception of mandatory

*METT-T stands for Mission, Enemy, Terrain and Weather, Time, and Troops.

supplements, such as bread, milk and cold cereal. Each UGR meal module also contains all required disposable items (cups, compartment trays, and utensils). The food is prepared by trained food service personnel using established food service facilities.

The **UGR-A Ration** consists of both shelf stable and food items that require refrigeration or freezing (semi-perishables and perishables) prior to preparation or serving, the same as A Rations in garrison. The UGR-A may be used in the field when appropriate food service equipment and personnel are available and the tactical environment permits. There are currently five breakfast and ten lunch/dinner menus available; these will soon expand to seven breakfast and fourteen lunch/dinner menus. Each menu, including mandatory supplements of bread, milk, and cereal, provides an average of 1450 kilocalories (kcal) (14% protein, 32% fat, and 54% carbohydrates).

The **UGR-Heat & Serve (UGR-H&S)** is a shelf-stable, ready-to-heat and serve ration packaged in short, rectangular plastic or metal trays. It is the more common (hot) group feeding ration for the field and is used when neither cooking nor refrigeration are possible. Each menu, including mandatory supplements, provides an average of 1450 kcal (kcal) (14% protein, 32% fat, and 54% carbohydrates). If at all possible, fresh fruit and salad should be provided as menu enhancements.

The **Arctic Supplement to the UGR-H&S** is used to augment the UGR-H&S ration to help meet cold weather energy requirements. The supplement module provides an additional 914 kcal in various snacks and hot beverages. The module also contains Styrofoam clamshell trays and hot cups with lids to maintain food temperature longer. The Arctic Supplement replaces the Cold Weather/Arctic T Ration.

The **Unitized B Ration** consists of canned and dehydrated foods that do not require refrigeration. This ration is used for group feeding in the field when kitchen facilities and food service personnel are available, but refrigeration may not be. It is also used in situations that do not permit resupply of perishable foods. This group ration is primarily used by the U.S. Marine Corps. Each Unitized B menu provides for 100 individuals. There are ten breakfast and ten lunch/dinner menus. This ration provides approximately 4300 kcal (13% protein, 33% fat, and 54% carbohydrate). If at all possible, fresh fruit and salad should be provided as menu enhancements.

The **Unitized Tray Pack Ration (T-Ration)** is presently used by the United States Marine Corps. It is designed to sustain groups of military personnel in highly-mobile field situations with nutritionally-adequate, hot meals. This ration is packaged in short, rectangular metal or polymeric cans (trays) and is ready to heat and serve. The T-Ration has 7 breakfast and 14 lunch/dinner menus, with each menu unitized into modules to feed 18 individuals. In addition to the food items, instant beverages, nondairy creamers, hot sauce, and disposables (cups, 5-compartment trays, and utensils) are included in each module. The 7 breakfast menus, including milk and bread supplements, provide an average of 1420 kcal (15% protein, 29% fat, and 56% carbohydrate) and the 14 lunch/dinner menus, including milk and bread supplements, provide an average of 1420 kcal (17% protein, 30% fat, and 53% carbohydrate). If at all possible, fresh fruit and salad should be provided as menu enhancements.

Individual Rations

Individual rations (also known as combat rations) are used when the mission or tactical scenario prevents group feeding. These rations provide single meals which can be consumed cold or hot. Individual flameless ration heaters (FRH) are provided with them; other field expedient methods can be used to heat these rations.

The **Meal, Ready-to-Eat (MRE)** is the standard individual operational ration and consists of heat-processed entrees and other food components that require no preparation. It is designed to sustain an individual engaged in heavy activity, such as military training or during actual military operations, when normal food service facilities are not available. For variety, there are twenty-four different menus in the inventory, with entrees ranging from beef teriyaki to Jamaican pork chops with noodles to vegetarian entrees. One MRE meal bag provides an average of 1300 kcal (13% protein, 36% fat, and 51% carbohydrate).

The **Meal, Ready-to-Eat, Vegetarian (VMRE)** consists of four meals which contain no animal or animal by-products and are for individuals who require a special ration for health or religious purposes but do not need a certified kosher or halal ration. The ration is identical to the regular MRE in packaging and contains many of the same components. The contents of one vegetarian meal bag provide an average of 1200 kilocalories (12% protein, 38% fat, and 50% carbohydrates).

The **Meal, Religious, Kosher or Halal** is utilized to feed service members who maintain a strict diet for religious reasons. Each meal consists of one kosher or halal certified entree and religiously certified/acceptable complementary items sufficient to provide the recommended meal nutrient standards. Like the MRE, it is a totally self-contained meal; however, it is not combined in a flexible meal bag. The Religious Rations are packed in two boxes, one box with the entrees and the other box with the accessory items. The religious meals contain approximately 1200 kcal (11%–13% protein, 37%–40% fat, and 48% carbohydrate).

The **Meal, Cold Weather/Food Packet, Long Range Patrol (MCW/LRP)** is a combination individual operational ration which provides for two separate operational scenarios. The **Meal, Cold Weather (MCW)** replaces the Ration, Cold Weather (RCW), which is no longer being procured, and is intended for cold weather feeding. The MCW/LRP is comprised of menus based on the **Food Packet, Long Range Patrol (LRP)**. The MCW menus are identical to those of the LRP, but its packaging is white to fit into the environment in which it is used. The MCW contains freeze-dried, cooked entrees and other low moisture foods; thus, it is lightweight and will not freeze. Many of its components can be eaten either dry or rehydrated. The MCW contains many drink mixes to encourage fluid consumption and prevent the dehydration often occurring during cold weather activities. It is issued at three menu bags per day for a complete cold weather ration. Three MCW menus provide roughly 4500 kcal, higher than the MRE because of the greater energy needs in extremely cold environments (see the chapter on Cold Weather Operations). Each menu provides approximately 1570 kcal (15% protein, 35% fat, and 50% carbohydrate). About 34 ounces of water is required to hydrate all components in the average menu bag.

The **LRP** is an extended shelf life, operational ration used to sustain personnel during special operations when weight and volume of the ration are critical factors. It is a restricted calorie ration when issued as one menu bag per day. As such, the LRP should not be consumed for more than ten consecutive days. It is nutritionally compatible with the MRE to allow menu mixes. The average menu provides 1560 kcal (15% protein, 35% fat, and 50% carbohydrate). The LRP is now available as the combined MCW/LRP, which consists of twelve menus,

Table 2. Basic Nutrient Content of General Purpose Ration Meals[1]

Nutrient	Unit	Standard[2] for full day ration	UGR[3]		MRE XIX[4]	MCW/LRP[5]
			Breakfast	Lunch or Dinner		
Energy	kcal	3600	1500	1500	1272	1572
Protein	g	100	52	59	40	51.5
Carbohydrate	g (%)	440 (50-55%)	220	205	161	228
Fat	g (%)	160 (≤40%)	45	55	53	54.5
Vitamin A	RE	1000	1360	1330	1434	1282
Vitamin C	mg	60	111	73	110	111
Calcium	mg	800	629	565	448	519
Iron	mg	18	16	13	7	11.7
Sodium	mg	5000-7000	2700	2650	1941	2841

[1]Nutrients provided, based on an average meal in the menu mix.

[2]Nutritional standards for operational rations (what a ration must contain) as presented in AR 40-25, dtd 15 May 1985. Publication of the revised regulation is expected in the 4th QTR FY01, in which the ration standards will change to 91 g protein, 494 g carbohydrate, <35% calories from fat, 90 mg vitamin C, 1000 mg calcium, and 15 mg iron.
The value given for fat is the maximum amount that should be provided per day. The value for carbohydrate is a "suggested" value, higher levels are permissible. These standards are different from the Military Recommended Dietary Allowances (MRDAs) or Military Dietary Reference Intakes (MDRIs), which are recommendations for nutrient intakes by service members (what should be consumed). There are no MRDAs for carbohydrate and fat.

[3] UGR, Unitized Group Ration.

[4]An average value for the 24 individual Meal, Ready-to-Eat (MRE) menus contained in MRE XIX ration as planned. The nutrient content of individual MRE menus may vary.

[5] MCW/LRP, Meal, Cold Weather/Food Packet, Long Range Patrol.

Survival Rations

The **Food Packet, Survival, General Purpose, Improved (GP-I)** is used to sustain personnel in any survival situation for periods of **less than 5 consecutive days**. It is intended for use under all environmental conditions and when potable water is limited. This ration contains six compressed bars—one sucrose bar, two cereal bars, three cookie bars—plus bouillon soup, lemon tea, and sugar. Each packet provides 1447 kcal (5% protein, 39% fat, and 56% carbohydrate). It is designed to provide a maximum of 8% of the calories from protein in order to minimize water requirements. About 14 ounces of water are required to reconstitute the tea and bouillon. It is normally packed in survival kits like those stored on board aircraft or small boats. Other survival rations—the Food Packet, Survival, Abandon Ship and the Food Packet, Survival, Aircraft, Liferaft—exist for Navy sea and air survival situations.

NUTRITIONAL ADEQUACY

Nutritional Standards for Operational and Restricted Rations (NSOR), presented in the Department of the Army Regulation 40-25, establish standards for the nutritional content of military rations, insuring that the rations maintain the nutritional status, health, and performance of military personnel. The NSOR are based on the Military Recommended Dietary Allowances** (MRDAs), which, in turn, are based on the dietary recommendations of the Food and Nutrition Board of the Institute of Medicine, National Academy of Sciences. This Board establishes the Recommended Dietary Allowances (RDAs), nutritional guidelines for the general American population. For some nutrients, the MRDAs have a higher requirement than the RDAs because soldiers are typically more physically active than their civilian counterparts.

All of the military rations, except restricted calorie rations, are nutritionally adequate, which is defined as meeting the NSOR (see Table 1). Operational rations are designed with dietary allowance levels of nutrients in an energy provision of no less than 3600 kcal. Individual menus (single meals) of the MRE or group rations are designed to contain, on average, one-third of the NSOR. Because of different food sources of nutrients and selective fortification of items, nutrients are not evenly

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** The MRDAs are being replaced by Military Dietary Reference Intakes (MDRIs) based on the conceptually new Dietary Reference Intakes (DRI) of the Institute of Medicine. DRIs update and expand the Recommended Dietary Allowances. MDRIs will appear in the 2001 AR 40-25.

distributed within the ration. Therefore, to achieve recommended intakes of protein, vitamins, and minerals, individuals must consume all components from all menu bags or meals each day.

Restricted Rations do not provide MRDA levels for most nutrients and should not be consumed for indefinite amounts of time. Restricted calorie rations are designed to only provide the minimal amounts of nutrients needed to maintain body functions and prevent rapid depletion of body stores. Healthy personnel can subsist for short periods (up to ten days) on restricted rations with minor decrements in performance or nutritional status. Additional information about the functions, requirements, and food sources of nutrients can be found in Appendix A.

NUTRIENT FORTIFICATION OF OPERATIONAL RATIONS

Since soldiers may have the option of picking and choosing which ration components to eat, it is important that they know which components have been fortified with nutrients and are encouraged to consume them. Table 2 describes the fortification of ration items. These particular foods were chosen to be fortified because the flavor of these foods was not affected by the flavors of the added nutrients. Some ration items are high in certain nutrients even without fortification (e.g., calcium in cocoa and cheese).

Table 3. Nutrient Fortification in Rations

RATION COMPONENT	VITAMINS						MINERALS	
	A	C	B_1	B_2	B_6	NIACIN	CALCIUM	IRON
Beverage base		X					X	
Cocoa beverage	X	X	X		X			
Cheese spread	X	X	X		X			
Jalapeno cheese spread	X	X	X		X			
Peanut butter	X	X	X		X			
Crackers			X	X	X	X	X	
Oatmeal cookie bar								X
Chocolate covered bar	X	X	X		X			X
Fruits		X						

B_1 = Thiamin; B_2 = Riboflavin; B_6 = Pyridoxine

QUESTIONS FREQUENTLY ASKED ABOUT MILITARY RATIONS

1. Why is there so much fat in the operational rations?

a. In comparison to typical garrison meals, there is actually not a large amount of fat in field rations. For example, an average MRE is 36% fat, whereas a garrison diet is typically 32% to 34% fat. Additional fat is needed in field rations to meet the 3600 kcal requirement.

b. Fat is a natural component in foods and contributes many of the desirable flavors and textures of foods.

c. Fat is a dense form of energy. One gram of fat provides 9 kilocalories compared to 4 kilocalories per gram of carbohydrate or protein. Rations with some fat content can be small and compact because fat provides so many calories. If the amount of fat in the MRE was reduced:

1) The MRE package would have to be larger and bulkier to provide the same calories.

2) The portion size of the protein components (meat entrees, cheese, and peanut butter) would be smaller since they contain much of the fat in rations.

3) The acceptability and texture of foods would be negatively affected.

2. Have the ration developers tried to design items without eggs for the breakfast T Pack or Heat & Serve ration menus?

Yes. SBCCOM food technologists have developed waffles which are included in two of the five breakfast UGR menus. Biscuits are included in the UGR-A. Eggs are the #1 breakfast item requested by soldiers. Change to the new polymeric trays may help eliminate the “metallic” taste of the Tray Pack eggs.

3. Why are MREs so high in salt/sodium?

a. The MREs are within MRDA guidelines for sodium content. One MRE (less the salt packet) provides approximately 1940 milligrams of sodium. Eating three MREs per day provides about 5820 milligrams of sodium (one gram of salt (NaCl) contains 393 milligrams of sodium).

b. The usual sodium intake of soldiers in garrison is 3000–7000 milligrams per day. Therefore, MREs' sodium content falls within the range of typical garrison intakes.

c. The level of sodium in the rations allows for optimum acclimation in all environments and insures adequate sodium replacement for sweat losses. The salt packets provide for higher sodium intakes when necessary (such as work in hot weather accompanied by high sweat rates).

4. Where is the fiber in the operational rations?

a. Since fiber is not one of the nutrients with a recommended dietary intake level, the rations have not been analyzed for fiber in the past. Estimated calculations of fiber content indicate that relatively good sources of fiber in the rations include: pouch bread, fruits, peanut butter, stews, rice-containing entrees, raisin nut mixture, cookies, and brownies.

b. The fiber content of field rations, while not generous, is adequate to prevent constipation. Insuring an adequate fluid intake is of greater importance in the prevention of constipation.

5. What is the shelf life of the ration?

a. The shelf life is the length of time that the ration can be stored without losing its nutritional value, wholesomeness and quality. The shelf life is different for each ration, but it is a minimum of 3 years at 80° F/27° C, or 6 months at 100° F/38° C for Individual Operational Rations. The shelf life of UGRs ranges from 6 months for the UGR-A to 18 months for the UGR-H&S. Taste and nutrient content may start to deteriorate in old rations, but generally speaking, if the packaging barrier is intact and no foul odor or swelling is noticeable, then the ration is probably safe to eat. If in doubt, don't eat it and check with the Veterinary Officer.

b. The minimum shelf life for specific rations, when stored at 80° F/27° C, is:

UGR –A	6 mos	MCW/LRP	3 yrs (entree up to 10 yrs*)
UGR-H&S	18 mos	GP-I	5 yrs
MRE	3 yrs		

*Freeze-dried entrees have been shown to have shelf-lives exceeding 10 years at ambient storage temperatures.

c. The extended shelf life of rations is due primarily to the special foil tri-laminated packages which protect against penetration by bacteria, oxygen, water vapor, and light. Military developed foods do not rely on chemical preservatives but do contain some natural food preservatives (such as vitamins C and E, which are antioxidants). Brand name items included in rations may contain natural food preservatives as well as chemical preservatives.

6. Why isn't pepper, mustard, ketchup, or butter included in the MRE Rations?

These items do not have a long shelf life and, therefore, are not included in most of the operational rations. New methods of packaging and processing are being tested to try to provide some of these items in rations.

7. Are the individual ration packages biodegradable?

No, at this time, ration packages are not biodegradable, so proper trash disposal measures should be followed whenever possible. Studies are underway to develop new packaging systems to reduce excess materials and to increase biodegradability.

8. Are any of the ration items irradiated?

The U.S. military does not currently use irradiation to preserve ration items. Irradiation is a process which applies energy (similar to taking a chest x-ray) to a food product to destroy parasites and bacteria that would cause the food to spoil. Some commercial food processors use irradiation to extend the shelf life of fresh fruits and vegetables, sanitize spices and herbs, and pasteurize raw meat. Products irradiated in the United States are approved by the FDA, which has based their approvals on over 50 years of worldwide research on the safety of the process and the wholesomeness of the food products.

NUTRITIONAL ADVICE FOR FIELD FEEDING

Food plays a major role in sustaining performance and morale in the field. Unit leaders must assure their soldiers are provided an adequate quantity of high quality food with ample time to eat. Commanders and food service officers should work together to tailor food supplies and food management to the tactical situation and unit mission.

This chapter presents general information applicable to field feeding in any environment. Brief descriptions of key nutrition issues in the field are followed by advice on how to manage these issues. The last section of the chapter provides answers to questions frequently asked about field feeding. Chapters 5–7 provide nutrition information applicable in specific extreme environments (hot, cold, and high-altitude).

KEY ISSUES

KEY ISSUES

- Dehydration
- Inadequate Energy and Carbohydrate Intake
- Gastrointestinal Complaints

Dehydration

Soldiers who do not consume enough fluids to replace those lost from sweating and urination become dehydrated and constipated. Even mild dehydration— body water losses amounting to as little as two percent of body weight—impairs performance, reduces the desire to eat, and causes sluggishness. Moderate dehydration leads to diminished work capacity, and more severe dehydration may result in severe disability or even death.

Inadequate Energy and Carbohydrate Intake

Weight loss (both voluntary and involuntary) is quite common in the field. Soldiers often eat 20% to 40% less than actual energy needs in the field due to a variety of factors. Soldiers often become bored eating military rations, causing a

decrease in voluntary food intake and morale. Monotony with rations can occur after just a few days in the field and is likely to become worse the longer a field exercise or deployment lasts. This is particularly true if the same ration is repeatedly served as the sole source of food. In addition, changes from the normal routine, not having enough time to eat, or high intensity, continuous operations can preclude an adequate intake. If this low food intake is not prevented, body weight loss can quickly reach a level where it impairs physical and mental performance. Even if soldiers are overweight, a low food intake may have a negative impact on performance.

Carbohydrate Depletion

Body stores of carbohydrate—the body's most important fuel source for physical and mental work— can be quickly depleted when soldiers perform prolonged, heavy exercise and do not eat enough. The **symptoms** of carbohydrate depletion include: muscle fatigue (which increases the risk of injury), lightheadedness, decreased endurance, inability to think clearly, weakness, and hunger.

Gastrointestinal Complaints

When in the field, military personnel periodically complain of gastrointestinal upsets such as diarrhea or constipation. These problems may be caused by the change in diet, or a combination of other factors such as poor sanitation, dehydration, and stress.

MANAGING THE KEY ISSUES

Maintain Adequate Hydration

1. Leaders should emphasize drinking in order to prevent dehydration. The actual amount of drinking to prevent dehydration is dependent upon the environment, work level, clothing worn, and load carried.

2. Provide plenty of fluids at meal times, preferably flavored and served at appropriate temperatures for the environment (cold beverages in a hot environment, hot beverages in a cold environment). A lack of fluids, or providing poorly accepted

beverages will have a dramatic negative impact on the amount of fluids (and food) consumed at a meal and could lead to dehydration.

3. Make time to eat. Eating balanced meals provides the source for the sodium and potassium necessary to maximize fluid retention. Food and fluids should be salted to taste preference on the first days of hot weather and/or the first days of heavy sweating to facilitate fluid retention.

4. Monitoring the color of one's urine helps determine hydration status. Dark yellow urine and infrequent urination indicates inadequate fluid intake; fluid consumption should be increased until urine turns pale yellow.

5. The chapter 'Nutritional Advice for Military Operations in Hot Environments' provides additional advice about the signs and symptoms of dehydration and what to do if dehydration occurs.

Maintain Adequate Energy and Carbohydrate Intake

Promote Ration Consumption

1. Soldiers must be taught that adequate consumption of food and water are tactical weapons; what they eat and drink can affect their health and performance. Well-disciplined and trained troops will generally insure their own food consumption patterns are appropriate if they are convinced that eating is important.

2. Unit leaders should watch to see what their personnel are eating or failing to eat. Often, no one knows a food problem exists because no one is actively looking for it. It is hard to fix a problem that is not recognized.

3. Do not assume that a meal issued is a meal fully consumed. Unit leaders should monitor food service areas to see which foods and food items are being eaten or discarded.

4. Do not permit troops to use field deployments as a convenient way of dieting. Many military personnel have a misconception that it is no big deal to lose weight while on field deployments.

5. Encourage soldiers to eat at least part of each of the ration items served. Even if the rations may not be what personnel would freely choose to eat or have become monotonous, the rations contain all the nutrients essential for health and fitness.

6. Establish regularly scheduled meal times and allow adequate time to eat if possible. Food intake is almost always higher at anticipated meals compared to impromptu meals and soldiers tend to eat more when they are in social groups for meals. Having as many scheduled meal and snack breaks as possible also boosts morale.

7. Prevent Ration Monotony.

a. Serve at least one prepared, hot meal per day. This is probably the simplest, most effective, single thing one can do to help maintain voluntary food intake and morale. It does not matter if the hot meal is an UGR-A, Unitized B, or UGR-H&S; all three can be equally effective.

b. Insure proper preparation of all meals. If a meal or single food is poorly prepared once, personnel will always perceive that particular food(s) as bad, regardless of how well it is prepared subsequently. Initial impressions are important and soldier acceptance is difficult to recover.

c. Work with logistical support personnel to insure that a variety of food items are made available to personnel. For example, there are 7 different UGR-H&S breakfast menus and 14 different dinner menus. Be sure the variety available is obtained and served. Obtaining locally procured supplements such as fresh fruits and vegetables, bread, and beverages can be helpful (make sure a Veterinary Officer approves local procurements). Almost anything different, especially if it does not come in a green can or brown pouch, will help break the monotony and maintain food intake.

Watch the Pogey Bait

Most military personnel pack supplemental food (pogey bait), especially snacks, to take along on field training exercises or deployments. Pogey bait can be a useful supplement to the military rations provided in the field. However, pogey bait should not be used to replace nutritious food. The goal should be to select nutritious pogey bait (instead of empty calorie snacks) that can improve a person's diet in the field. Additionally, it is important that soldiers do not eat so much of these extraneous foods that they are not hungry enough to eat their rations.

High-fat foods, such as nuts, cheese, jerky, sausages, and empty-calorie candies, should be used sparingly. A little of these foods is permissible, but eating too much of these foods will leave personnel less hungry for the more nutritious rations or complex carbohydrate snacks. The best snacks are high-carbohydrate, easy to prepare, easy to eat on-the-go, easy to digest, taste good, and are worth the weight and space they take up in the pack. High-carbohydrate foods—whether pogey bait or ration items— help replenish the body's stores of carbohydrate (muscle and liver glycogen).

Good Complex-Carbohydrate Choices:

- fresh, dried, or canned fruit
- granola bars
- crackers
- hot chocolate
- hot or cold breakfast cereals (oatmeal, Cream of Wheat, Cheerios, Chex, etc.)
- juices (liquid or powders)
- instant mashed potatoes or rice
- Cup of Noodles, Ramen
- Fruit Newtons (fig, apple, strawberry, etc.)
- bagels
- toaster pastries
- trail mix

"Energy" bars and electrolyte and carbohydrate-enhanced drinks may improve performance during sustained operations, particularly if there is limited opportunity for consumption of a meal. However, these items may be more expensive and are not an appropriate substitute for a meal.

Treat and Prevent Carbohydrate Depletion

Ingestion of carbohydrates usually rectifies the situation. Ideally, 50%–55% of the daily calories should be carbohydrates. Carbohydrate foods include crackers, fruits, vegetables, breads, pastas, and the sweetened beverage base provided in the MRE.

Good snack items to combat carbohydrate depletion include sweetened beverages (like sugar-sweetened Koolaid, not artificially sweetened), granola bars, hard candies, and trail mix.

Avoid Gastrointestinal Complaints

1. Assume all native foods are contaminated and might cause gastrointestinal illness. An appropriate Veterinary Officer must inspect all locally procured foods.

2. Prepare all foods in a facility with the resources to guarantee sanitation and wholesomeness.

3. Following is advice for dealing with the common diet-related gastrointestinal complaints encountered in the field.

Diarrhea

Definition: The excessive excretion of watery stools (instead of formed or soft stool) with resulting decrease in absorption of water and nutrients.

Causes include:

- Poor personal hygiene (transmission of bacteria by unwashed hands, utensils, etc.)
- Food allergies
- Intestinal virus
- Food poisoning
- Dysentery
- Emotional stress
- Excessive drinking of alcohol

Symptoms

- Frequent loose and watery stools
- Stomach cramping
- Tiredness (due to loss of potassium)
- Thirst (due to fluid loss)
- Blood streaks in or on stools

Treatment is mainly concerned with prevention or correction of salt and water depletion. The American Medical Association suggests the following:

1. Consume a liquid diet for a day or so. Suggestions: tea, clear broth or soup, carbohydrate/electrolyte drink, beverage base.
2. Avoid solid foods, but consume large volumes of fluid.
3. If diarrhea persists longer than a day or two, or if urine decreases in frequency and amount, seek medical attention because severe dehydration may occur.
4. If bloody stools or stools that are black in color occur, or if severe or prolonged stomach cramping occurs, seek prompt medical attention.

Constipation

Definition: A symptom, not a disease, and characterized by retention of feces in the colon beyond the normal emptying time.

Causes include:

- Dehydration
- Fiber deficient diets
- Rectal diseases
- Diseases of the colon
- Lack of exercise (decreases intestinal muscle tone)
- Abrupt living habit changes
- Drugs (e.g., analgesics, antacids)
- Discontinuation of a prolonged use of laxatives

Symptoms are excessive straining, pain, and incomplete bowel movements.

Treatment and Prevention should include general measures such as increasing fluid intake, increasing the intake of dietary fiber, and exercise. In the MRE, fiber is relatively abundant in the raisin nut mixture, peanut butter, and beef stew. If constipation persists, contact a medical officer.

QUESTIONS FREQUENTLY ASKED ABOUT FIELD FEEDING

1. Do I have to eat all of the components of a ration to get enough nutrients?

Each ration meal is intended to provide 1/3 of the Military Recommended Dietary Allowances (MRDAs). Various food items are high in certain nutrients. You should eat a variety of food items in the ration, rather than selecting only a few components, to insure you get your required nutrients. Tables in the preceding chapter list the nutrients in the operational rations.

2. Are vitamin supplements a good idea?

If you eat the recommended three meals per day, vitamin supplementation is not needed. Rations contain more than the MRDAs for vitamins. This extra fortification helps to insure an adequate intake of vitamins even when personnel do not consume their entire ration at every meal.

3. Is "pogey bait" good or bad for me?

Pogey bait can be a useful "nutritional supplement" to obtain extra calories and variety, but it should not be used as a meal substitute. Although pogey bait is not necessarily "bad," it often replaces more nutritious foods, and it should be used with caution.

4. Once the individual ration packet is opened, how long can leftovers be carried?

Once a wet-pack ration component is opened, consume the contents within two hours. The dry ration components can be consumed within two days if protected from contamination by insects, rodents, dust, humidity, etc.

5. What are the best ways to heat an individual ration?

a. The best way of heating an individual ration depends upon tactical and logistical constraints. The recommended ways are:

1) Flameless ration heaters
2) Immersing food pouches in hot water
3) Heating tablets

b. The following **are not** good ways of heating the rations since the food next to the surface may burn:

1) Laying food pouch on engine block
2) Laying food pouch on stove

6. Do dehydrated foods increase my water requirements?

a. Only the MCW/LRP (and remaining RCWs) contains dehydrated foods. When these items are consumed, more water is needed to prepare dehydrated ration items. But the body's total water requirement does not increase. If soldiers eat the dehydrated component dry, they will need to drink the extra amount of water that would have been used to rehydrate the ration. The RCW and MCW were designed with extra drink mixes to help ensure adequate water consumption.

b. Water requirements for reconstituting different rations when using a 1 quart (i.e., 32 oz) canteen or 24 oz canteen cup:

1) The entire RCW requires about 3 canteens (i.e., 90 oz) to hydrate all the ration components including beverages (about ½ canteen cup [12 oz] for each main entree alone).

2) An MCW/LRP meal bag requires about 1 canteen to hydrate all components, or ¾ canteen cup (16 oz) for each entree (i.e., three MCW/LRPs would require about 3 canteens of water).

DOs and DON'Ts for FIELD FEEDING

DO accentuate the positive aspects of the ration; food is a tactical weapon. It maintains mental and physical performance.

DO emphasize water discipline.

DO provide group/hot meals whenever possible; soldiers tend to eat more when eating "socially."

DO schedule meal times when possible, even when individual operational rations are the planned meal.

DO watch to see what the soldiers are eating.

DO encourage consumption of the fortified ration components.

DON'T assume that a ration issued is a ration fully consumed.

DON'T allow soldiers to use field exercises as weight loss programs.

DON'T allow consumption of foods locally procured unless approved by food inspection officer.

DON'T allow pogey bait to become a replacement for more nutritious rations.

DON'T take nutritional supplements instead of eating meals.

NUTRITIONAL ADVICE FOR MILITARY OPERATIONS IN A HOT ENVIRONMENT

Survival in a hot environment depends on respect for the heat, constant vigilance, judicious work/rest cycles, and adequate fluid and food intake. The primary purpose of this section is to increase awareness of the importance of adequate hydration and nutrition for preserving the health, performance, and morale of soldiers subsisting in hot environments. This section also provides some practical guidance on how to avoid serious heat injuries and illness through adequate fluid and dietary intake, and how to recognize signs and symptoms of problems.

KEY ISSUES

- Dehydration
- Inadequate Food Intake
- Water-Borne Illness
- Food-Borne Illness

KEY ISSUES

Dehydration

The most critical need in hot environments is adequate fluid replacement. The body cools itself through the evaporation of large amounts of sweat (water) when the environment is hot. Heavy work increases sweat rates and the likelihood of dehydration and other heat injuries. Maximum sweat rates can exceed the body's ability to absorb fluids. In hot environments, sweat rates of 1-1.5 quarts per hour are not unusual and are higher when soldiers wear chemical protective clothing. Failure to replace fluid lost through sweating can lead to dehydration. This, in turn, increases an individual's susceptibility to heat injury or illness.

To further compound this problem, an individual's normal thirst mechanism does not insure one will voluntarily drink enough fluid to replace fluid lost through sweat, especially during strenuous physical activity. Therefore, it is essential that leaders take an active role to avoid and minimize the risks of dehydration of their troops. Since soldiers are unlikely to drink enough fluids voluntarily, unit commanders must implement and enforce policies to insure that they consume enough fluids.

Inadequate Food Intake

Failure to consume sufficient food energy is a frequent problem which can increase the risk of dehydration and heat injury/illness. Soldiers are known to reduce their food intake by as much as 40 percent during field operations. Inadequate food intake has been attributed to decreased appetite, poor ration palatability, menu boredom, inability to work on a full stomach, lack of water, lack of specific meal periods, lack of time to prepare meals, anxiety due to field conditions, and intentional dieting.

It has long been thought that individuals living and performing hard work in temperatures ranging from 86°F to 104°F (30°C to 40°C) require slightly more calories to do the same amount of work as they would under more temperate conditions. However, this has not been proven. Even if there is a modest increase in energy expenditure in the heat because of the added work of the temperature regulating systems, there is usually no increase in total daily energy requirements because of the tendency to restrict unnecessary activities in extremely hot surroundings. Inadequate food intake results in body weight loss that can eventually impair physical and mental performance. Poor food intake decreases the intake of salt necessary to retain water.

Food is also a source of water and can account for up to 10 percent of total fluid intake**. More than half of all fluids are consumed at mealtimes.** If soldiers skip meals or voluntarily limit their food intake, then the amount of fluids consumed will also decrease.

Water- and Food-Borne Illness

Emphasis should be placed on following proper field sanitation practices to prevent disease in hot environments. High temperatures encourage microbial growth and activity in both water and food sources. Water- and food-borne illnesses can have a profound impact on an individual's hydration status and susceptibility to heat injury or illness by causing nausea, vomiting, diarrhea, and fever. Hence, command emphasis on proper field hygiene and sanitation techniques is critical. History has demonstrated that whole units have been disabled due to poor sanitation.

MANAGING THE KEY ISSUES

Maintain Adequate Hydration

1. Adjust fluid intake and work/rest cycles as temperature varies (See Table 4 on the next page and Figure 2 on page 38). Approximately four to six quarts of water per day are recommended for light work in warm weather. More water is needed as physical work and temperatures increase. Up to **twelve quarts** of water per day may be required by military personnel working in hot environments. Although hourly sweat rates can be high enough to theoretically lead to water losses greater than twelve quarts per day, total daily water needs would rarely be greater than this because of the necessity to shorten heavy work periods as ambient temperatures increase. It is imperative that commanders consider the amount of water necessary at different environmental temperatures to support the corresponding work/rest schedules.

2. Emphasize routine water consumption. Soldiers need to drink even when they are not thirsty. It is best to plan a schedule for drinking. Remember that it is much better to drink small amounts of water frequently (e.g., one-fourth of a canteen every 15 to 30 minutes) than to drink large amounts less frequently.

Table 4. Fluid Replacement Guidelines for Warm Weather ***in a training school environment*** (applies to average, acclimated soldier wearing BDU, Hot Weather)

Heat Category	WBGT Index, °F	Easy Work		Moderate Work		Hard Work	
		Work/Rest	Water Intake, Qt/hr	Work/Rest	Water Intake, Qt/hr	Work/Rest	Water Intake, Qt/hr
1	78–81.9	NL	½	NL	¾	40/20 min	¾
2 (Green)	82–84.9	NL	½	50/10 min	¾	30/30 min	1
3 (Yellow)	85–87.9	NL	¾	40/20 min	¾	30/30 min	1
4 (Red)	88–89.9	NL	¾	30/30 min	¾	20/40 min	1
5 (Black)	> 90	50/10 min	1	20/40 min	1	10/50 min	1

- WBGT, Wet-Bulb Globe Thermometer
- The work–rest times and fluid replacement volumes will sustain performance and hydration for at least 4 h of work in the specified heat category. Individual water needs will vary ± ¼ qt/hr.
- These fluid intake guidelines assume individuals are consuming typical amounts of sodium (4-8 grams per day) and are initially well-hydrated.
- NL= no limit to work time per hour.
- Rest means minimal physical activity (sitting or standing), accomplished in shade if possible.
- **CAUTION**: Hourly fluid intake should not exceed 1½ quarts.
- Daily fluid intake **should not exceed 12 quarts in basic training-type environments.**
- When wearing body armor, add **5°F** to WBGT Index.
- When wearing the Military Oriented Protective Posture (MOPP) overgarment, add **10°F** to WBGT Index.

Table 5. Categorization of Work Effort

Easy Work	Moderate Work	Hard Work
• Weapon Maintenance • Walking Hard Surface at 2.5 mph, w/ 30 lb Load • Manual of Arms • Marksmanship Training • Drill and Ceremony	• Walking Loose Sand at 2.5 mph, no Load • Walking Hard Surface at 3.5 mph, w/ 40 lb Load • Calisthenics • Patrolling • Individual Movement Techniques, i.e., low crawl, high crawl • Defensive Position Construction • Field Assaults	• Walking Hard Surface at 3.5 mph, w/ 40 lb Load • Walking Loose Sand at 2.5 mph with Load

Another method to determine daily water requirements:

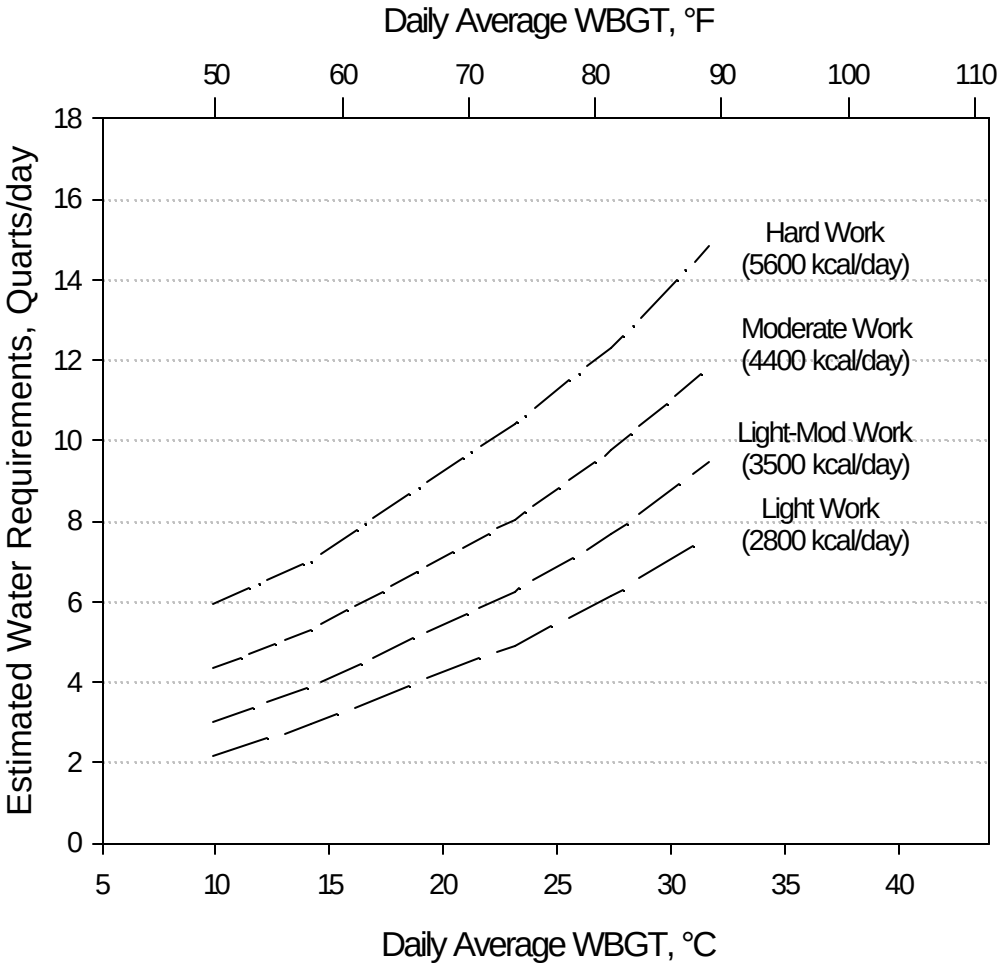
✎ Determine the average daily environmental conditions. Averaging the low and high expected daily climatic conditions should suffice. Wet-bulb globe temperature (WBGT) is equal to: $0.7 * T^{\circ}_{\text{wet bulb}} + 0.2 * T^{\circ}_{\text{globe}} + 0.1 * T^{\circ}_{\text{dry bulb}}$. It is unlikely that the average conditions will exceed 30°C (86°F).

✎ Identify the estimated daily water requirements by Using Figure 2 on page 38, matching the expected climatic conditions with the expected energy expenditure. Approximate energy expenditures for various military activities are provided in Table 6.

Table 6. Approximate daily energy expenditure of soldiers in various training environments

Type of Training	Calories Burned Per Day	
	Women	Men
Military Basic Training	2000-3000	3000-4000
Marine Officer Candidate School	2200-3200	3600-4800
Army Ranger School	N/A	3600-4800
Navy SEAL Training	N/A	4000-5000
Mountain Training	N/A	4600-6000
Arctic Field Training, Infantry	N/A	3200-5000
Reconnaissance & surveillance mission, including infiltration & exfiltration	N/A	3000-3700
Marine Crucible Exercise	4500-5000	6500-7000
Combat Support Hospital Staff in garrison	2000-2500	3000-3500
Combat Support Hospital Staff in field	2500-3000	3700-4200

Figure 2 Estimated Daily Water Requirements* as a Function of Energy Expenditure Under Given *Average* Climatic Conditions



*Predicted from the USARIEM Heat Strain model.

3. Provide palatable water. Plain, cool (60-70°F; 15-21°C) water is the best beverage for maintaining adequate hydration status since it is easily emptied from the stomach and is absorbed quickly into the rest of the body. Nevertheless, almost any type of beverage consumed will help soldiers meet their water requirement (e.g., Koolaid, juice, decaffeinated coffee, tea, soft drinks, lemonade, soups, milk). Drinking alcoholic beverages increases urination and the tendency for dehydration. Although caffeine does increase urine formation and cause water loss, the caution to abstain from caffeine has been overstated. Caffeine is a very mild diuretic and leads to a loss of less water than the water in the beverage it is consumed in. Caffeine is mainly a problem when all fluid intake is caffeine-based. To be cautiously conservative, don't count beverages with caffeine when adding up fluid intake for the day. Beverages can be cooled by shading, insulating, and camouflaging water buffaloes or by using small mobile chillers.

4. Monitor soldiers for signs of dehydration.

a. Train soldiers to monitor the color and volume of urine. If urine is dark yellow or orange and less than normal, they are probably dehydrated. Have soldiers drink (no more than 1½ quarts per hour) until their urine turns pale yellow in color.

b. Monitor weight loss if possible. Weight loss is a good indicator of dehydration. Even mild dehydration (indicated by a loss of 2% of body weight) can affect an individual's physical performance, mood, and the desire to eat, and increase the risk of heat injury/illness.

c. Have soldiers monitor themselves for signs of dehydration or illness. Encourage the use of the "buddy system" to help detect signs of dehydration and illness in others.

Understand Dehydration

Dehydration is the net result of inadequate fluid replacement in the face of normal or accelerated fluid loss. It can happen at any temperature, whether physical activity is involved or not. The causes of dehydration mainly involve weather factors combined with physical exertion and inadequate fluid replacement. Dehydration can also be caused by illnesses causing diarrhea or vomiting or alcohol-induced urine losses.

The symptoms of dehydration depend on the proportion of body weight lost due to dehydration. Fluid loss resulting in as little as 2% loss of body weight can compromise physical performance. A 3% to 5% loss in body weight leads to a diminished work capacity, while a 10% to 15% loss results in severe disability and even death. The following chart summarizes the symptoms of dehydration at different percentages of body water loss (listed as percent of body weight loss).

Table 7. Symptoms of Dehydration as Percentage of Body Weight Loss

1% - 5%	6% - 10%	>10%
Thirst	Dizziness	Delirium
Vague discomfort	Headache	Muscle spasms
Fatigue	Difficulty breathing	Swollen tongue
Appetite suppression	Tingling in limbs	Inability to swallow
Flushed skin	Absence of salivation	Deafness
Impatience	Bluish tinge to skin	Dim vision
Sleepiness	Indistinct speech	Shriveled skin
Increased pulse rate	Inability to walk	Painful urination
Nausea		Numb skin
		Kidney dysfunction

Treatment varies depending on the degree of dehydration. For the least severe cases, simply drinking enough fluids (preferably water) to replace lost fluids, getting plenty of rest, and getting out of the sun should help solve the problem. For the more severe cases of dehydration (symptoms in the 6% to10% range and higher), it should be treated as an emergency by seeking prompt professional medical attention, including intravenous fluid replacement.

Prevention techniques include ingestion of adequate water prior to working in the heat. For example, drinking 13 to 20 ounces of water beforehand will delay dehydration. While working, ½–1 quart of fluid per hour may be needed to prevent dehydration. Special attention should be paid to consuming meals because the majority of fluids are consumed at meals.

Prevent Hyponatremia

While the message to drink before, during, and after exercise is important, soldiers can drink too much or too quickly, especially if they are not consuming enough sodium because of missed meals or dietary choices. Rapid ingestion of plain water or other sodium-free drinks in amounts greater than 1½ quarts per hour may lead to low blood sodium, a condition called hyponatremia. The symptoms can range from mild to severe and can include nausea, muscle cramps, extreme fatigue, weakness, disorientation, slurred speech, confusion, and inappropriate behavior—confusingly very similar to the symptoms of dehydration. If hyponatremia progresses, the individual can experience seizures or coma and may die.

Mild symptoms of hyponatremia, such as nausea or mild muscle cramps, can be treated by eating salty food and drinking a sodium-containing sports drink. More severe symptoms require treatment by qualified medical personnel. Severe hyponatremia is a medical emergency.

Maintain Adequate Food Intake

1. Soldiers should be encouraged to eat at least two balanced meals per day. Individuals should not use the field as an opportunity to lose weight. Although appetites may be depressed and monotony may reduce acceptance, consumption of rations should be maintained. Field rations contain all the essential nutrients needed to maintain health and physical fitness. Soldiers need to eat some of all the food items issued to insure adequate nutrition and salt intake. Failure to replace salt can lead to salt depletion, dehydration, nausea or vomiting, muscle cramps, or more serious problems. Do not restrict water/beverage intake with meals or the amount of food consumed might also decrease. Commanders should monitor serving lines, watch what and how much soldiers are eating, and intervene when appropriate to prevent problems from developing.

2. Adequate food intake helps maintain adequate sodium intake. Complete replacement of body water cannot occur without also replacing the sodium and other electrolytes lost in sweat. Under most circumstances, military rations contain adequate amounts of salt to replenish the sodium that is lost in sweat. However, during the initial eight days of heat exposure, especially if soldiers are not heat acclimatized, they should lightly season their meals with table salt. When food intake is decreased drastically

(e.g., only one or two meals per day), additional salt in the form of a very dilute salt solution may be necessary. This solution can be made by adding one-third teaspoon table salt to each quart of drinking water. Salt tablets should never be used without the recommendation and monitoring by a medical officer, since they can easily be consumed in excess of sodium needs and produce gastrointestinal (GI) disturbances.

3. The ideal diet for hot weather operations is one that focuses on complex carbohydrates, with adequate protein and moderate fat. Carbohydrates serve as a fast fuel source, replace muscle carbohydrate (glycogen) stores, and spare protein reserves. In addition, glycogen (carbohydrate stores) in the body is stored with water. When these carbohydrate stores are burned during physical activity, metabolic water is produced and the water bound to glycogen is released. This metabolic water can then be used by the body during exercise to help replace water lost through sweating. (When the glycogen stores are replaced, the water that must be stored with glycogen also has to be replaced.) Supplemental items that are high in carbohydrate but low in protein and fat (such as breads, crackers, jelly, fresh/dried fruit, and juice) will help individuals maintain proper hydration, enhance physical and mental performance, and prevent body weight loss.

Avoid Water- and Food-Borne Illness

1. Provide only properly inspected and adequately treated water. Ice sources must also be inspected, just as for water. Water inspections can be done by the unit preventive medicine officer.

2. Flavored beverages should not be added directly to canteens or bulk water storage containers. The effectiveness of water disinfectants is reduced by flavorings added to the canteen. In addition, canteen water may be required for emergency hygiene (e.g., eye wash) or wound cleansing. All traces of flavorings need to be rinsed out completely before disinfecting the next canteen of water. Flavorings are best mixed in a canteen cup and drunk completely after mixing.

3. Never eat uncooked or unpeeled fresh fruits and vegetables in developing countries, where produce is frequently grown in soil contaminated with human excrement (night soil) and may cause diarrheal disease. Such foods must be approved first by the veterinary officer.

QUESTIONS FREQUENTLY ASKED ABOUT WATER AND FOOD INTAKE FOR A HOT ENVIRONMENT

1. Doesn't the body's thirst mechanism tell people whether they are drinking enough fluids?

Thirst can be a good indicator of adequate fluid intake, but often it is not due to many factors. The thirst mechanism becomes dulled during and after vigorous exercise. Some individuals also simply ignore their thirst. A good method to avoid dehydration is to drink before you feel thirsty. Some of the physical signs of dehydration are: absence of urination, yellow or orange concentrated urine, lack of appetite, vague discomfort, lethargy, weariness, sleepiness, and apathy.

2. Is water the best fluid to consume after vigorous physical activity in the heat?

Plain water is the beverage of choice, although a carbohydrate-electrolyte beverage may be beneficial during some hot-weather field operations. The purpose of using such a beverage should be to maximize fluid intake, replace electrolyte losses, and provide a carbohydrate source for energy and rapid replenishment of muscle and liver glycogen stores during and following physical activity. Since most "sport drinks" are lacking in vitamins and protein they should not be routinely substituted for more nutritionally balanced foods or beverages.

3. Does hot weather decrease food requirements?

No. It is a common misconception that the amount of food needed decreases during hot weather. Although the desire to eat goes down, the amount of calories required actually increases slightly in hot weather. Appetite suppression will be a bigger problem during the first few days of heat exposure and will gradually go away within a few weeks. It is a more serious problem in troops that are not heat acclimatized.

4. Does hot weather increase my requirement for vitamins?

There may be an increased requirement for the vitamins that are needed for energy metabolism, since energy requirements may be increased during extremely hot weather. Most of the packaged rations are fortified with vitamins. However, since some foods are better carriers for these nutrients than others, the vitamin content is often unevenly distributed among the ration items. Eating a variety of ration components will help insure sufficient vitamin intake.

5. Does hot weather increase my requirement for minerals?

During hot weather operations sweat rates naturally increase. Sodium and chloride (salt) are the principal minerals lost in sweat. The amount of salt lost in sweat varies depending on a person's degree of acclimatization. During the first four to five days of heat exposure, sweat will contain more salt. As the body adjusts, or acclimatizes to the heat, sweat will contain less salt. While military rations contain adequate amounts of salt for most circumstances, during the first few days of heat acclimatization, food may be lightly salted using the packets provided with the rations. Remember, however, that high salt meals cause a shift in the body's fluid balance. It is important to consume enough fluid with meals to maintain fluid balance.

DOs AND DON'Ts FOR HOT WEATHER HYDRATION AND NUTRITION

DO coordinate drinking and work/rest cycles.

DO maintain and enforce routine water and food discipline.

DO provide adequate quantities of sanitary, palatable water.

DO instruct soldiers to monitor the color and relative volume of their urine to check for dehydration.

DO monitor weight loss if possible.

DO eat slightly more food than usually eaten in garrison.

DO encourage consumption of at least two meals per day to replace the salt lost in sweat.

DO encourage consumption of complex carbohydrate foods and beverages.

DO establish specific meal times and have soldiers continue to consume snack foods throughout the day as time permits.

DON'T allow soldiers to become dehydrated.

DON'T eat foods that are salty or high in protein if water is not available.

DON'T use the deployment to a hot environment as an opportunity to start a diet.

DON'T skip meals.

DON'T consume unsanitary ice.

DON'T add flavorings such as beverage base, glucose-electrolyte powder or other commercial drinks directly to a canteen or bulk water storage container.

DON'T eat uncooked or unpeeled fresh fruits and vegetables during operations in developing countries.

NUTRITIONAL ADVICE FOR MILITARY OPERATIONS IN A COLD ENVIRONMENT

Proper nutrition is an often overlooked but critical component of successful operations in cold conditions. An important goal of cold weather training is to prevent hypothermia and avoid subsequent risk of disabling cold injury. Food plays a role in prevention of hypothermia since it is the primary source of fuel for body heat production. Food also supports the high energy requirements of working in the arctic. There is no better investment in the safety, well-being, efficiency, and morale of troops than providing plenty of hot, tasty food and warming beverages. This chapter provides guidance on the nutritional concerns likely to be encountered during cold weather operations and offers suggestions for coping with these issues.

KEY ISSUES

KEY ISSUES

- Hypothermia
- Dehydration
- High Energy Requirements

Hypothermia

Hypothermia is a decrease in core body temperature to a level at which normal muscular and brain functions are impaired. Hypothermia occurs when the body's cold-defense mechanisms cannot keep up with the demand for heat. The most important first lines of defense against hypothermia and cold injury are adequate clothing and shelter; however, food is an often overlooked ally against the cold. Remember that food ultimately fuels the heat-generating shivering response. A lack of critical metabolic fuels (carbohydrate, protein, and fat) limits shivering.

Dehydration

Military personnel often become dehydrated during cold weather operations. Problems with frozen water and eating field rations (lower in water content than most garrison foods) contribute to reduced fluid intake in cold weather operations. Dehydration can reduce appetite and lead to lethargy (fatigue and weakness) and low

energy levels. Lethargy is not a desirable physical state in the cold, since physical activity is necessary to generate heat. It is widely accepted, but not proven, that dehydration decreases blood flow to fingers and toes, thereby increasing the risk of cold injury. However, the potential increased risk of frostbite when dehydrated is more likely due to fatigue and mental changes which contribute to poor judgement and accidents.

High Energy Requirements

Calorie requirements of military personnel can be 10% to 15% higher during cold-weather operations than in temperate or hot weather. Under conditions of heavy work, requirements can increase up to 40% greater than work in a temperate climate. Several factors contribute to this increased caloric need: (a) wearing heavy cold weather clothing, (b) increased effort needed for moving through snow or preparing positions in frozen ground, and (c) the body's physical mechanisms (shivering) to stay warm. The calories from the food consumed are necessary for two principal purposes: (a) to produce heat during both times of activity and rest and (b) to fuel muscular activity. While energy requirements are high, energy intakes are often reduced because soldiers find it difficult to obtain, prepare, and serve food in the cold.

MANAGING THE KEY ISSUES

Prevent Hypothermia

1. Proper diet and food management can help insure that fuel is available for the shivering response and heat production. The role of food in providing energy for physical activity and heat production is often unappreciated during the chaos of cold weather military operations. **The key to cold weather nutrition is providing hot, palatable food**. Hot food and hot beverages help provide a warming sensation that will improve morale and satisfy appetites made keen by hard physical work in the cold. Eating hot meals together in a group also improves morale.

2. Eating food cold, just because soldiers are too busy to eat it when it's hot or too busy to stop and heat individual rations, may cause them to eat less food and miss out on the warming and psychological lift warm food provides. Warm food tastes better

and helps maintain body temperature and comfort in the cold. Group rations such as UGR-A and UGR-Heat & Serve should be prepared and served hot. Individual rations such as the MRE or MCW/LRP can be heated using the pocket stove, heat tabs, flameless ration heaters, etc.

3. Eating regular meals and hearty snacks should help maintain higher skin and body temperatures and prevent excessive shivering. The practice of eating a small meal before entering the sleeping bag in the cold will help soldiers to sleep warmer and awaken less often during the night.

Maintain Adequate Hydration

1. Soldiers must drink even when they are not thirsty. Leaders should establish a program of regularly scheduled drinking.

a) Soldiers should drink at least 2–6 canteens of water each day.

b) Cold suppresses thirst, so schedule drinking at regular intervals. Actual fluid requirements are dependent upon the level of physical work performed, what the temperature is, and what soldiers are wearing and carrying.

2. If a soldier's urine shows dark yellow it may indicate that fluid intake is not adequate; the soldier should increase the quantity drunk until urine turns pale yellow.

3. Eating snow or ice for moisture is inefficient, may irritate the lining of the mouth, and may lower body temperature. It is better to melt snow or ice and purify it before consuming.

4. A cup of hot coffee or tea can be a welcome "pick-me-up" in the cold, but excessive caffeine consumption leads to difficulty sleeping, depending upon individual tolerances. Soldiers should be cautious to avoid sudden withdrawal from caffeine, however, as this can cause adverse symptoms such as severe headaches and nausea. Cocoa is generally a better beverage than coffee in the cold. Cocoa is much lower in caffeine, high in needed carbohydrate, and is warming.

5. Consuming alcoholic beverages may be detrimental in the harsh cold. Drinking alcoholic beverages give a false feeling of warmth and can impair judgement.

6. Avoid consuming excess salt (more than that normally provided in the military rations).

Maintain Adequate Energy Intake

1. Eat an adequate amount of rations. A good general rule of thumb is that military personnel will need to increase their calorie consumption by approximately 10% to 40%, depending on their activity level, to meet the extra energy requirements of cold weather operations. For example, in garrison, an average female burns 2300 kcal/day and an average male burns about 3250 kcal/day. The energy requirement when participating in cold weather field training may increase to approximately 3150 and 4500 kcal/day or higher for females and males, respectively. The RCW and MCW were designed specifically to meet these higher caloric demands.

2. Meeting the high calorie demands can also be accomplished by eating "normal" breakfast, lunch, and dinner meals with frequent nutritious snacks during the day and a small "snack meal" right before bedtime. Save extra foods from meal times to eat for mid-morning, mid-afternoon, and evening snack meals. Choose snacks that require minimum preparation such as: oatmeal, granola bars, MRE crackers, MRE bread, cheese spread, peanut butter, candies, cookies, soups, and cocoa.

3. Military personnel should be discouraged from using field training exercises in cold weather as an opportunity to lose weight. Dieting may compromise the body's ability to prevent hypothermia and decrease job performance (both mentally and physically).

4. Personnel may hear many anecdotal stories alleging that high-fat diets or foods may be especially beneficial to helping the body tolerate the cold. While some of these stories may have some basis in scientific fact, what the body really needs is just adequate caloric intake to maintain body temperature in the cold. High-fat diets may work just fine for Eskimos who are used to them, but may not work so well for those accustomed to the more moderate fat content of the typical western diet. The human

body can adapt remarkably well to high-fat diets but this takes time (weeks). Greatly changing normal dietary patterns may result in gastrointestinal and bowel problems.

QUESTIONS FREQUENTLY ASKED ABOUT WATER AND FOOD INTAKE FOR A COLD ENVIRONMENT

1. Does cold increase my requirement for vitamins and minerals?

a. Cold weather does not directly increase the body's requirements for vitamins or minerals. The body may need more vitamin or minerals to help metabolize the extra calories needed in cold weather operations. Military rations, if eaten to caloric adequacy, contain more than enough vitamins and minerals to meet the requirements.

b. There is no good scientific evidence that excess vitamins, such as vitamin C, "ward off colds." A well-balanced diet that includes adequate vitamins will help the body maintain it's resistance to colds, flu, etc.

2. How many calories are needed for cold weather military training?

Moderately active military personnel in garrison require an average of 2300 kcal/day for females and 3250 kcal/day for males. Work in the cold may require 3400–4600 kcal/day. A day's worth of military issue cold weather rations is designed to provide 4500 kcal. (Three MREs total 3900 kcal, three LRPs total 4680 kcal, one MCW contains 4500 kcal, and a typical UGR-H&S meal with the cold weather supplement provides about 2300 kcal.)

3. What is a good cold weather snack?

Almost any component or supplement from military rations makes a good snack—trail mix, oatmeal or granola bars, peanut butter or cheese and crackers, MRE cakes and cookies, hot cocoa, hot sweetened beverages, and soups. Consumption of high-protein and salty snacks does require extra fluid intake to maintain the body’s fluid balance, however. Commercially purchased snacks may also be appropriate. Candy should be considered a supplement to, not a replacement for, rations.

4. Would carbohydrate loading benefit work in the cold?

a. Possibly; it depends upon the type of work that will be done. Carbohydrate loading is the practice of eating a very high-carbohydrate diet, while physical activity levels are reduced in order to cause the body to store extra glycogen (carbohydrate). Having maximum quantities of stored glycogen helps maintain energy for doing endurance type activities such as traveling relatively long distances on skis or snowshoes. Carbohydrate loading won't be of any special advantage for work such as heavy lifting (for example, loading or unloading trucks) or driving vehicles.

b. Though true carbohydrate loading may or may not be necessary, eating a high-carbohydrate diet on a regular basis is suggested to help maintain the body's energy supply. Eating a high-carbohydrate diet may cause soldiers to feel hungrier sooner, since carbohydrates leave the stomach faster, but eating three meals per day with snacks will alleviate this problem. MRE and UGR food items high in carbohydrate are bread, crackers, fruits, potatoes, rice, cookies, cakes, and sugar-sweetened beverage powders.

5. What about pemmican?

Pemmican is an energy-dense, relatively high-fat product favored by arctic explorers as food for both man and sled dog because of its lack of bulk. Pemmican is made by grinding dried meat and fat together. Some recipes call for the addition of fruits and berries. It requires a period of adaptation or "getting used to it" to reset the body's metabolic machinery to burn such a high-fat diet. Pemmican consumption is not practical for military operations. Tests of pemmican by the military during World War II were not encouraging. Try pemmican sometime; it might increase one's appreciation of military rations!

6. Does the military have a special cold weather ration?

The usual cold weather feeding plan consists of the UGR-H&S with the Arctic Supplement module and the MRE. The military does have a 4500 calorie dehydrated packaged field ration (the Meal, Cold Weather) available for missions requiring rations with minimum weight and bulk.

Cold Environments

7. Do dehydrated foods increase water requirements?

No; more water is needed to prepare (hydrate) the food items in the dehydrated Meal, Cold Weather, but the body's total daily water requirement will not be different. If a dehydrated item is eaten dry, the amount of water normally needed to rehydrate that item must be drunk in addition to normal fluid intake requirements. The cold weather rations are designed to help water consumption via the provision of drinks and soups.

DOs AND DON'Ts FOR COLD WEATHER NUTRITION

DO eat 10%–40% more calories than usually eaten in garrison.

DO heat food and beverages at every opportunity prior to eating.

DO drink more than thirst dictates.

DO eat snacks between meals and before going to sleep.

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DON'T eat snow or ice for moisture.

DON'T adopt bizarre dietary habits (such as eating only meat and butter) just because of being in the cold.

DON'T take multivitamin tablets to "ward off cold stress."

DON'T eat food cold because of being too busy to eat it when it's hot or too busy to stop and heat MRE food items.

DON'T use field training exercises in cold weather as an opportunity to lose weight.

DON'T consume alcohol to "ward off" cold.

NUTRITIONAL ADVICE FOR MILITARY OPERATIONS IN A HIGH-ALTITUDE ENVIRONMENT

At altitude, a soldier must be able to perform skilled movements with speed, coordination, and repetition. These movements must be done without excessive fatigue, often in severe cold and dangerous conditions, and with deficient oxygen. Training, skill, and equipment, in addition to health and fitness, are necessary for successful mountain operations; but diet is of paramount importance in helping maintain body weight, nutritional status, and mental and physical alertness. This chapter provides information on the nutritional requirements altered by exposure to altitude, the effect that diet may have on tolerance to altitude, and the problems in meeting nutritional requirements at altitude.

KEY ISSUES

KEY ISSUES

- **Weight Loss**
- **Low Carbohydrate Intake**
- **Dehydration**
- **Gastrointestinal Complaints**

Weight Loss

Eating enough food is the most important nutritional factor at altitude. Almost all persons going to altitude lose weight due to loss of appetite secondary to hypoxia. This weight loss is a combination of body fat and lean tissue, and at very high altitudes the weight loss can be incapacitating. The loss of insulating fat can decrease tolerance to cold temperatures. Accompanying the weight loss are fatigue, loss of strength, and psychological changes such as decreased mental alertness and morale. All of these can contribute to accidents and failure to accomplish the mission.

Energy requirements for high-altitude operations are increased up to ~10% above sea level requirements. The altitude, cold temperatures, and performance of physical activities over rugged terrain combine to increase energy expenditures to as much as 5000 kcal per day.

Although energy expenditure increases, food intake usually decreases due to lack of appetite, limited availability of food, and difficulty in food preparation. During the first seven days at high altitude, a condition called acute mountain sickness (AMS) may occur, and symptoms such as headache, nausea, vomiting and pronounced loss of appetite interferes with food and fluid intake. Even after the symptoms of AMS subside, appetite remains depressed and it takes less food to reach a feeling of fullness. The higher the altitude, the greater the appetite depression.

The sense of taste is reduced and food preferences are altered at altitude. These taste changes may decrease tolerance to monotonous foods. Individuals often go hungry at high altitude rather than eat food which they do not crave. Many mountaineers report an aversion to fat and a preference for carbohydrates.

Military personnel commonly report lack of time to prepare and consume food and beverages as the reason for limited consumption. This problem is compounded at altitude where cooking times double for each 5000-foot gain in elevation (partly because the temperature of boiling water is reduced). Cold ambient temperatures and thin air mean that food starts out colder and heat dissipates faster at altitude. Providing adequate amounts of hot rations is a major challenge for leaders during high-altitude operations.

Low Carbohydrate Intake

Carbohydrate is the preferred energy source at altitude (although the need for a balanced diet still exists). Carbohydrates replace depleted muscle glycogen stores, prevent protein being used as energy, and require less oxygen for metabolism. A high-carbohydrate diet improves physical performance and mental efficiency and may reduce the onset and severity of AMS. A low-carbohydrate diet can result in low blood sugar. Low blood sugar causes confusion, disorientation, and lack of coordination; and can be an extremely dangerous condition when combined with oxygen deficiency.

The optimal diet at altitude contains at least 400 grams of carbohydrate, accounting for 60%–70% of dietary energy. Such a high carbohydrate intake is very difficult to achieve unless a concerted effort is made to consume high-carbohydrate foods. Female soldiers are at particular risk of inadequate carbohydrate intakes because of their relatively low calorie consumption.

The supposed taste preference for high-carbohydrate foods cannot be counted on to insure an adequate carbohydrate intake. Not everyone exhibits this food preference, especially at lower altitudes. Many of the common snacks or pogey bait items that soldiers bring to the field are high in fat and, therefore, displace preferred carbohydrate from the diet. Typical high-fat foods that soldiers bring to the field are cheeses, summer sausage, and jerky.

Dehydration

It is easy to become dehydrated in high-altitude environments. Dehydration exacerbates the fatigue, impaired judgement, and apathy of hypoxia and, thereby, increases the risk of accidents and cold injury. The body's requirement for fluids is very high at altitude, often exceeding four liters of water per day. This is mainly caused by a modest increase in water losses from the lungs due to the increased ventilation of cold, dry air. There is also increased urinary loss of water due to the diuretic effects of altitude and cold. Sweating due to physical exertion adds to the water loss. Especially in the first few days at altitude, there may be significant body water losses due to the vomiting associated with AMS. Diarrheal fluid losses may also be a factor. Giardia, an intestinal parasite that causes diarrhea, is common in high-altitude regions. Also, the high magnesium content of glacier water, consumed as drinking water, can have a laxative effect.

Complicating the excessive water losses at altitude is the difficulty consuming adequate fluids. The sensation of thirst does not keep pace with water loss. Individuals do not feel like drinking, even when they are already dehydrated. AMS further exacerbates the dulling of the thirst sensation. Other symptoms of AMS include headache, nausea, vomiting, and the loss of appetite.

Potable water is difficult to obtain in high-altitude environments. Because of the large water requirement at altitude, a day's supply cannot be carried by an individual soldier. When temperatures are very low, water in canteens and bulk water containers may freeze, restricting water availability. It takes an exorbitant amount of time and fuel to melt snow in sufficient quantities for the provision of adequate amounts of water. All melted snow and ice, as well as water from streams, is potentially contaminated and should be boiled or filtered and treated before consumption, further adding to the time factor.

Gastrointestinal Complaints

Ingestion of contaminated food or water can cause mild to disabling diarrhea. Constipation is a common complaint during any field exercise. It is especially prevalent at altitude where decreased oxygen slows down the function of the intestines and excessive fluid losses rob water from the colon.

Many soldiers complain of intestinal gas at high altitudes. Responses to particular foods are highly individual and, therefore, difficult to predict. Dehydrated foods high in carbohydrate may tend to cause gas production and should be tried in small quantities until tolerance is established.

MANAGING THE KEY ISSUES

Prevent Weight Loss

1. Provide adequate calories.

    a. The suggested energy allowance for high-altitude operations is 4500 kcal per day. This can be met by providing four MREs if no other rations are to be provided. Three MCW/LRP meal bags would also meet the daily calorie allowance. The MCW/LRP requires about 3 quarts to rehydrate all food components in three meal bags.

    b. Items from the Arctic Supplement to the UGR-H&S can provide high-carbohydrate foods to enhance energy, carbohydrate, and fluid intakes of soldiers subsisting on A, Unitized B, or UGR Rations. Carbohydrate-containing beverage supplements can increase both calorie and fluid intake at high altitude.

2. Serve at least one hot meal daily if at all possible. Individuals voluntarily consume more food and beverages when they are served hot meals in a group setting.

3. Use a variety of foods and food items. Monotony will be the biggest problem developing over time. Any food becomes tiring with repeated consumption. Almost anything different will help to maintain food intake.

4. Encourage small meals plus frequent snacks. Large meals are poorly tolerated at altitude. Soldiers often cannot consume enough food to meet their nutrient requirements in two or three meals a day. It is a good idea to save food items such as granola bars, candies, cookies, crackers, cheese and peanut butter spreads to eat as between-meal snacks that require minimal preparation.

5. Respect individual food preferences and tolerances. Do not force food when soldiers are nauseous or vomiting. Do, however, encourage fluids. Food aversions are quick to develop and hard to get rid of. Even favorite foods can become repulsive at altitude if they become associated with the nausea and vomiting of AMS.

Maintain a High-Carbohydrate Intake

1. Emphasize high-carbohydrate foods (starches and sugars). Aim for an intake of at least 400 grams of carbohydrate per day. High-carbohydrate items include hot and cold breakfast cereals, juices and sugar-sweetened beverage base, fruits (dried, canned, or fresh), instant mashed potatoes, rice, couscous, noodles, MRE and UGR cakes, crackers, cookies, and pouch bread. High-carbohydrate beverages may be better tolerated than solids and will also serve to provide needed fluid.

2. Discourage high-fat, pogey bait snack items. Although high-fat foods are energy dense, fat is not tolerated well at high altitude. Fat yields less energy per volume of oxygen consumed than does carbohydrate. Also, even a very lean soldier has adequate fat reserves to meet an energy deficit on a short-term basis; but the body has limited carbohydrate stores which must be replaced on a daily basis if a high work capacity is to be maintained. High-fat snack foods such as nuts, cheese, jerky, and sausage can displace preferred carbohydrates. If high-fat foods are tolerated and desired, they should be eaten with carbohydrate foods.

3. Have available easy-to-digest, high-carbohydrate foods for periods of AMS. Bland, easy-to-tolerate foods that might appeal to soldiers suffering from AMS include Cream of Wheat or oatmeal, instant mashed potatoes, instant rice, Ramen noodles, crackers, bread, and vanilla pudding. A liquid high-carbohydrate, glucose-polymer "sport drink" may be helpful to ensure adequate calories and carbohydrate intake if solid foods become unpalatable. They also provide an electrolyte source (when

feelings of AMS restrict food intake). Intolerance to solid foods is most likely to happen during the first two to three days at altitude when the symptoms of AMS are most severe or at the extremely high altitudes.

Prevent Dehydration

1. Encourage a program of regularly scheduled drinking, and remind soldiers to drink even when they are not thirsty. A scheduled intake of one canteen of water during every three-hour period is recommended so that at least 5 quarts of water are consumed each day. If, and only if, the training schedule prevents frequent stops to drink, one to two canteens drunk morning and evening can help compensate for limited fluid intake during the day. During periods of nausea, small, frequent sips of liquid are tolerated better.

2. Provide a variety of non-caffeinated beverages. Warm fluids are well received in cold temperatures. However, in caffeine-sensitive individuals, excess caffeine can interfere with sleep which is already disrupted at altitude. Cocoa is a good warming beverage since it is low in caffeine and contains needed carbohydrate. Other beverage suggestions are hot cider or apple juice, hot Jell-O, or instant soups.

3. Instruct soldiers to monitor the color and volume of their urine to check for dehydration. If urine is dark yellow or orange or less than normal, the soldier is probably dehydrated. As long as they are eating and, therefore, consuming salt, soldiers should be drinking enough so that their urine is pale yellow in color.

Avoid gastrointestinal problems

1. Ensure all water consumed is potable water, to include water used when brushing teeth. Filtering alone is not sufficient. The process of heating water to a boil makes it hot enough long enough to disinfect it, even at elevations as high as the Mt. Everest Base Camp. There is no need to boil drinking water for 5,10, or 20 minutes, as previous guidelines recommended. If chlorine or iodine disinfectant, is used, treat first, then add flavorings.

2. Promote adequate water intake. Allow adequate rest breaks. Adding vitamin C (ascorbic acid) to water that has been treated with iodine completely eliminates the

taste and the color of the iodine. Make sure that the iodine has completely done its job first (for 20 to 30 minutes) before adding a small amount of vitamin C (about 50 mg).

3. Adhere to all food safety guidelines. Make sure any locally-procured foods are inspected and approved by a veterinary officer. If in a developing country, stay clear of uncooked vegetables and wash and peel fresh fruits.

4. Introduce dehydrated foods, if they will be used, into the diet before deployment so that soldiers can gradually get used to them.

QUESTIONS FREQUENTLY ASKED ABOUT WATER AND FOOD INTAKE FOR A HIGH-ALTITUDE ENVIRONMENT

1. Does altitude increase the requirement for vitamins and minerals?

There is an increased requirement for the vitamins needed for energy metabolism since energy requirements are increased at altitude. There is evidence to suggest that the body's need for vitamins A, E, and C may increase at altitude. This does not mean that vitamin intakes have to increase. Military rations already provide more than enough vitamins and minerals.

2. Is an iron supplement beneficial?

Since the red blood cell count increases at altitude to allow the blood to carry more oxygen, it has been suggested that extra iron should be taken. However, unless there is a pre-existing iron deficiency, there are sufficient body iron stores to meet this sudden but short-term need. Therefore, it is important to insure an adequate dietary intake of iron before deployment to high-altitude regions, especially for female soldiers who have a higher iron requirement than do male personnel.

3. Weight loss at altitude is inevitable, so why bother trying to maintain weight?

Most of the weight loss commonly seen at altitude is not inevitable but is due to the reduced calorie intake. Weight loss can be prevented or slowed down by keeping calorie intake up. Only at extreme altitudes (above 18,000 feet) is there body wasting regardless of dietary intake.

4. Will protein supplements prevent muscle loss at altitude?

No. Adequate protein is needed to protect against muscle loss, but protein requirements are not increased at altitude. Too much protein can be dehydrating because it produces protein waste products which must be excreted in the urine, thus increasing urine output. Also, protein requires more oxygen for metabolism than does carbohydrate. Nevertheless, protein foods should not be overly restricted just because of the emphasis on carbohydrates. Good protein sources are the ration entrees, eggs, milk, cheese, and peanut butter.

5. What are good snacks for high-altitude environments?

The best snacks are high-carbohydrate, easy-to-prepare, easy-to-digest, taste good, and are worth their weight and space to carry. Personal preference ultimately decides the best snack. Sugars taste less sweet at altitude, so foods that are too sweet at sea level may taste better at altitude. Suggested snacks are raisins and other dried fruits, yogurt-covered raisins, banana chips, fruit chews, jelly beans, Chuckles, Gummie Bears, Necco wafers, red and black licorice, granola bars, bagels, toaster pastries (without the toaster!), and fig bars. Be aware that most candy bars are high in fat as well as sugar. Although "sport" bars and drinks may seem to be ideal snacks, they are no more nutritious than military ration items or grocery store foods (but much more expensive!).

6. Would carbohydrate loading benefit work at altitude?

Yes and no. The classic regimen of glycogen or carbohydrate loading, in which muscle glycogen stores are manipulated to higher than normal levels, is mostly of benefit for continuous, endurance activities that last longer than 90 to 120 minutes. True carbohydrate loading requires a tapering of exercise in the days prior to the "event" to allow the resting muscle to "supercharge." Military training scenarios could rarely accommodate this reduction in physical activity. Of more importance to military operations at altitude is the replenishment of glycogen stores on a daily basis. Adequate carbohydrates (400-600 grams) are needed every day to continuously replace muscle glycogen stores.

7. Are fluid requirements increased due to working at altitude?

Yes. Physically active soldiers generally need at least **four to six quarts** of fluid per day when at altitude. At least one quart of fluid must be consumed every three hours to meet the requirement.

8. Would salt/sodium restriction prevent high-altitude edema?

No. The edema often seen at high altitudes is not caused by sodium retention, so limiting salt/sodium intake is of no benefit. In fact, sodium losses in the urine may be slightly increased at high altitude. Military rations provide adequate sodium.

9. What should I eat when I am sick?

Bland, low-fat foods (such as crackers, bread, cookie bars, mashed potatoes, rice, cereals, and puddings) are generally better tolerated. Small amounts of food should be eaten frequently - every two hours. Encourage drinking as much fluid as can be tolerated. Don't force personnel to eat if they know they can't keep it down. Don't let them go too long without eating; starvation sets up body changes that can start a cycle of poor appetite and weight loss that is hard to break.

10. Is it okay for soldiers to consume alcohol at altitude?

Alcohol is particularly dangerous at altitude where one needs to deal with cold temperatures and hazardous terrain. Alcohol increases body heat loss and decreases the blood supply to the exercising muscle. In the absence of food, such as after an overnight fast or a missed meal, or following a bout of exercise, small amounts of alcohol may produce a marked fall in blood sugar. Sugar is the fuel for the brain. A fall in the supply of sugar to the brain can result in confusion, disorientation, and poor coordination—a potentially deadly situation at altitude. In addition, the body requires more oxygen to metabolize alcohol. Contrary to popular belief, alcohol does not help soldiers sleep better at altitude. Alcohol accentuates the disrupted sleep observed at altitude.

DOs AND DON'Ts for HIGH ALTITUDE NUTRITION

DO monitor weight loss if possible.

DO emphasize a high-carbohydrate diet, preferably complex carbohydrates.

DO serve at least one hot meal per day.

DO provide a variety of foods and snacks.

DO discourage high-fat, pogey bait snack items.

DO encourage consumption of portions of all ration components.

DO schedule and enforce drinking, making sure soldiers drink at least 4 to 6 quarts of beverages per day.

DO provide a variety of non-caffeinated beverages.

DO monitor the color and volume of urine to check for dehydration.

DO discourage alcohol consumption.

DON'T allow soldiers to use a mountain exercise as an opportunity to lose weight.

DON'T skip meals.

DON'T fill up on high-fat foods.

DON'T force food when nauseous or vomiting.

DON'T drink unpurified water or melted snow.

DON'T restrict water intake in order to "save it for later" or avoid having to urinate.

NUTRIENT FUNCTIONS AND SOURCES

NUTRIENT	FUNCTION	SOURCES		
		Garrison/A or B Rations	MRE	UGR-H&S or T Ration
Protein	Build and maintain tissue; regulate water balance; formation of hormones, enzymes, and antibodies; excess intake used as energy	Meat, fish, cheese, milk, poultry, eggs, whole grains, nuts, beans	Entrees, cheese, peanut butter	Meats, entrees, milk, cheese, peanut butter
Carbohydrate	Primary energy source; dietary fiber (non-digestible carbohydrate) assists the digestion system	Whole grains, sugars, fruits, vegetables	Desserts, fruits, cocoa, candy, beverage base (sugar-sweetened)	Pudding, cakes, rice, potatoes, lasagna, bread
Fat	Provide energy; supply fatty acids for cell membranes; absorption of fat-soluble vitamins	Oils, butter, cheese, nuts, margarine, salad dressings	Peanut butter, entrees, cheese	Breakfast entrees
Water	Transport of vital substances through body; eliminate wastes from body; regulation of normal body temperature	Beverages of any kind, foods with high water content (especially fresh fruits and vegetables)	Beverages, entrees, wet-pack fruits	Beverages, entrees, fruits

For information on recommended intakes of nutrients, see AR 40-25, Nutrition Standards and Education.

NUTRIENT	FUNCTION	SOURCES		
		Garrison/A or B Rations	MRE	UGR-H&S or T Ration
Calcium	Build and maintain teeth & bones; normal blood clotting; muscle contraction; healthy cell membranes	Milk, green leafy vegetables, shellfish, dried beans	Crackers, cheese, cocoa	Lasagna, milk, cheese, macaroni & cheese
Phosphorous	Build bones & teeth; release energy from carbohydrates, fats, and protein; form genetic materials, cell membranes, and many enzymes	Fish, meat, poultry, eggs, legumes, milk, nuts, whole grains	Potatoes au gratin, ham entrees	Lasagna, pot roast, potatoes au gratin, chicken
Magnesium	Build bone & protein; release energy from muscle glycogen; regulate body temperature	Leafy green vegetables, milk, nuts, corn, soybeans, seeds, whole grains	Peanut butter, entrees, cakes, cocoa, coffee	Meats/entrees, bread, cocoa
Iron	Help blood supply oxygen to cells; part of some proteins & enzymes	Red meat, liver, kidneys, egg yolks, leafy green vegetables, dried beans & peas, dried fruits, potatoes, whole grains	Entrees	Entrees
Zinc	Essential role in formation of protein (wound healing, tissue growth); component of numerous enzymes	Oysters, meat, liver, eggs, poultry, seafood, seeds, dried beans, whole grains, milk	Entrees, cakes	Beef entrees
Sodium	Regulate body fluid volume and blood acidity; transmission of nerve impulses	Salt, salted snacks, soy sauce, tomato juice, canned and processed foods	Salt, entrees	Salt, spaghetti, omelets, rice
Potassium	Muscle contraction; maintain fluid & electrolyte balance; transmission of nerve impulses; release of energy from carbohydrate, fat, & protein	Orange juice, bananas, dried fruits, seeds, potatoes, meats, bran, peanut butter, dried peas & beans, coffee, tea,	Entrees, cocoa, peanut butter, fruits (FD)	Beef & pork entrees

NUTRIENT	FUNCTION	SOURCES		
		Garrison/A or B Rations	MRE	UGR-H&S or T Ration
Vitamin C	Formation of collagen (structure of bones, cartilage, muscle); maintain small blood vessels, bones, & teeth; aid iron absorption	Citrus fruits, tomatoes, strawberries, green peppers, potatoes, dark green leafy vegetables	Fruits, cocoa, peanut butter, cheese, beverage base (sugar-sweetened)	Beverage base, cocoa, cheese, peanut butter
Vitamin B_1 (Thiamin)	Release energy from carbohydrate; normal function of nervous system	Pork, liver, oysters, enriched cereals, oatmeal, pasta, bread, milk, leafy green vegetables, whole grains	Cocoa, crackers, cheese, peanut butter	Cheese, cocoa, peanut butter, hamburger rolls
Vitamin B_2 (Riboflavin)	Release energy from carbohydrate, protein, & fat	Whole grains, enriched breads & cereals, liver, meat, dark green leafy vegetables, fish, poultry, egg yolk	Crackers, entrees	Lasagna, pot roast, ham/eggs, pork w/BBQ sauce
Niacin	Work with thiamin & riboflavin for energy production	Liver, tuna, poultry, enriched bread & cereals, meat, nuts, dried peas & beans, pasta	Entrees, crackers	Entrees, bread
Vitamin B_6 (Pyridoxine)	Formation of certain proteins; aid in use of fats	Whole grains, meat, eggs, fruits & vegetables, liver, fish, poultry, cereals & bread, nuts	Cheese, cocoa, entrees, crackers	Cheese, beef hash, cocoa, chicken breast & gravy
Folacin	Formation of hemoglobin in red blood cells; formation of genetic material	Whole grains, enriched cereals, dried beans, leafy green vegetables, liver	Nut cakes, entrees	Lasagna, chicken cacciatore, pork w/BBQ sauce, western omelet
Vitamin B_{12}	Red blood cell formation; normal function of nervous system; assist in building genetic material	Milk, cheese, eggs, meat, fish, oysters	Entrees	Pork w/BBQ sauce, pot roast, chili, BBQ beef
Vitamin A	Healthy skin, hair, mucous membranes, teeth, & bones; aid night vision	Liver, eggs, cheese, butter, milk, fruits and vegetables	Cheese, entrees, cocoa, peanut butter, brownie, cookies	Carrots, peas/carrots, cocoa, cheese
Vitamin E	Protect vitamin A and fatty acids from oxidation; prevent cell membrane damage	Vegetable oils, margarine, green vegetables, whole grain cereals & breads, liver	Meat balls w/ rice, nut cakes	Omelets, pound cake, lasagna, bread pudding w/ ham

APPENDIX B

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