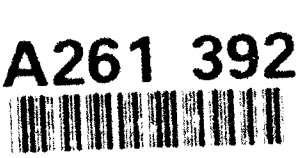

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NUTRITION FOR HEALTH AND PERFORMANCE

Nutritional Guidance for Military Operations in Temperate and Extreme Environments

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The purpose of this report is to augment and supplement, but not replace, current military policy. It is intended as a guide and reference for U.S. military small unit commanders and NCOs. Included are descriptions of all military rations, information on ration nutrient fortification, and ration composition. In addition, nutrition guidance is provided for military operations in temperate and extreme climates, and altitude. Answers are provided for frequently encountered ration questions. Appendices contain information on garrison dining and nutrition, the Military Recommended Dietary Allowances (MRDAs), foods providing certain nutrients, common nutrition-related medical complaints with suggestions for relief, and references for further reading.

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FOREWORD

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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INTRODUCTION

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

Military leaders must insure 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 "fit to win" eating habits themselves.

This technical note provides guidance for proper nutrition in field environments. Soldiers performing physically demanding field missions are especially receptive to information on diet and physical performance. This technical note is written for anyone who has questions, concerns or needs information on military rations including commanders, small unit leaders and the individual soldier. The first two chapters present general information and suggestions for planning nutritional support of military personnel operating in any field setting. 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.

MILITARY RATIONS

The cornerstone of field feeding is the military ration. Rations are of four types: Group Feeding Rations, Individually Packaged Rations, Restricted Rations, and Specialty 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 U.S. Army Natick Research, Development and Engineering Center (NRDEC) 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 Soldier Science Directorate, NRDEC, 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 allows for longer shelf life of the foods and frequently to be more compact or lightweight for ease of carrying.

RATION DESCRIPTIONS

Group Feeding Rations

Group feeding is used whenever the opportunity for a group of soldiers to eat together as a unit is possible. Prepared and served hot to the soldiers, the meals are often referred to as "hot meals."

1. The **A Ration** consists of both shelf stable (semi-perishable), and food items that require refrigeration (perishables) prior to preparation. A-rations is commonly used in garrison feeding and may be used in the field when appropriate food service equipment and personnel are available and the tactical environment permits. Under current 1993 field feeding policy, soldiers in the field usually do not get more than two A Rations per week.

2. The **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 is not.

3. The **T Ration** is a ready-to-heat and serve ration packaged in short, rectangular metal cans (trays). It is the more common (hot) group feeding ration for the field and is used when neither cooking nor refrigeration are possible.

Individually Packaged Rations

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

1. The **Meal, Ready-to-Eat** (MRE) is the basic operational ration and consists of heat-processed food components which require no preparation. For variety, there are a dozen or more different main entrees in the inventory ranging from beef stew to omelet. It is packed in flexible pouches (flexible cans), from which the food can be consumed, instead of using mess gear. The most recent MRE, version XIII, comes with a FRH prepackaged in each menu bag.

2. The **Go to War Ration (GTW)** is designed as a "back-up" ration during war time or emergency situations. It consists of commercial, shelf stable products packaged with two FRHs in a menu bag for an individual meal. The GTW ration does not provide the functional utility or shelf life required of the MRE.

Restricted Rations

Restricted rations are individual rations for use under certain operational scenarios such as long-range patrol, assault, reconnaissance, or when resupply is unavailable.

1. The **Ration, Lightweight** (RLW-30) is a low-weight, compact ration designed to sustain individuals with special needs, like the Special Operations Forces during reconnaissance missions for **up to 30 days**. The ration consists of dehydrated, compressed and intermediate moisture foods that are high in energy. This ration is adequate in vitamins and minerals but restricted in calorie content. Although the specifications to procure the RLW-30 are available, as of early 1993 this ration is not yet being procured.

2. The **Food Packet, Long Range Patrol** (LRP) is an extended shelf life operational ration used to sustain personnel during initial assault and special operations. The LRP-I components are dehydrated or low moisture. The entrees are pre-cooked, freeze-dehydrated, and reconstitute rapidly with either cold or hot water. This ration is currently categorized as a restricted ration (not adequate in energy or other nutrients) when fed one per day. When fed only one per day, the ration should not be consumed for more than 10 consecutive days to avoid excessive weight loss and prolonged suboptimal nutrient intake. When personnel consume three LRPs per day, the ration provides adequate nutrients.

3. The **Food Packet, Survival, General Purpose** is used to sustain personnel in any survival situation for periods **less than 5 consecutive days**. This ration contains six compressed bars: one sucrose (sugar), two cereal, three cookie bars, and a beverage base. It is normally packed in survival kits like those stored on board aircraft or small boats.

Specialty Rations

Specialty rations are designed to meet the increased nutritional requirements imposed by exposure to an extreme environment (such as extreme cold weather).

1. The **Ration, Cold Weather** (RCW) is an individual ration used to sustain soldiers during operations occurring under extremely cold conditions. The RCW 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. There are two meal bags per ration to provide food for 24 hours. The ration is adequate in nutrients and contains additional calories to meet cold weather energy requirements.

2. The **Cold Weather T Ration** is a T Ration with the addition of a supplement module to meet cold weather energy requirements. The supplement module, which provides an additional 1020 Calories per meal, consists of MRE pouch bread, soup, extra hot beverages,

nondairy creamers, oatmeal cookie bars, and candy. The module also contains styrofoam clamshell trays and hot cups with lids to maintain food temperature longer.

NUTRITIONAL ADEQUACY

1. Military Recommended Dietary Allowances (MRDAs) establish standards for the nutritional content of military rations, insuring that the rations maintain the nutritional status, health, and performance of military personnel. The MRDAs are based on the recommendations of the Food and Nutrition Board of the National Research Council. This Board establishes the Recommended Dietary Allowances (RDAs)--the 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.

2. All of the military rations, except the Restricted Rations, are nutritionally adequate which is defined as meeting AR 40-25 Nutritional Standards for Operational Rations (see Table 1 in Appendix B). The Restricted Rations do not meet the MRDAs for some nutrients and should not be consumed for indefinite amounts of time (see Table 2 in Appendix B). Additional information about the functions, requirements, and food sources of nutrients can be found in Appendix C.

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[1] with nutrients and encouraged to consume them. Table 3 (Appendix B) 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. See Appendix C for information on which ration items are good sources of various nutrients.

[1]Fortification means adding nutrients to a product in excess of its normal nutrient composition.

QUESTIONS FREQUENTLY ASKED ABOUT MILITARY RATIONS

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

a. When a ration has not been heated, the fat rises and hardens. This normal amount of fat in the ration adheres to the surface of the food and makes items look higher in fat than they really are.

b. In comparison to typical garrison meals, there is actually not a large amount of fat in field rations. For example, an MRE is 36% fat whereas a garrison diet is typically 35% fat.

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

d. Fat is a dense form of energy. One gram of fat provides 9 Calories compared to 4 Calories 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 were 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 mouthfeel of foods would be negatively affected.

2. Have the ration developers tried to design items without eggs for the breakfast T ration menus?

NRDEC food technologists are working on pancakes, waffles, and biscuits for the T ration. In addition, a family of highly acceptable freeze-dried eggs is under development.

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 1800 milligrams of sodium. Eating three MREs per day provides about 5400 milligrams of sodium (one gram of salt (NaCl) contains 383 mg of sodium).

b. The usual sodium intake of soldiers in garrison is 3,000-6,000 milligrams per day. Therefore, MREs are not much higher in sodium than 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. However, due to the increased national emphasis on dietary fiber and health, NRDEC plans to analyze the rations for fiber in the near future. Estimated calculations of fiber content indicate that relatively good sources of fiber in the rations include: pouch bread, fruits, peanut butter, potatoes au gratin, stews, rice-containing entrees, nut cakes, cookies, and brownies.

b. The fiber content of field rations, while not high, is adequate to prevent constipation. Insuring an adequate fluid intake is of greater importance in 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. It varies from ration to ration, but generally it is a minimum of 3 years at 80°F/27°C, or 6 months at 100°F/38°C. Rations older than 3 years are usually not encountered; taste and nutrient content may start to deteriorate in old rations. 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 preventive medicine officer

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

T Ration	3 years	GTW	18 months
MRE	3 years	LRP	10 years
RLW-30	3 years	GP	5 years
RCW	3 years		

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

6. Why isn't pepper, mustard, ketchup, or butter included in the 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 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 for new packaging systems to reduce excess materials and to increase biodegradability. Specific examples include a new biodegradable spoon and accessory packet materiel used in the MRE.

8. Are any of the ration items irradiated?

The U.S. military does not use irradiation to preserve ration items. Irradiation is a process which applies radiation (similar to taking a chest x-ray) to a food product to destroy parasites and germs that may cause the food to spoil. Some commercial food processors use irradiation to extend shelf life.

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 3-5 provide nutrition information applicable in specific extreme environments (hot, cold, and high-altitude).

KEY ISSUES

KEY ISSUES

- **Inadequate Ration Consumption**
- **Dehydration**
- **Monotony with Rations**
- **Gastrointestinal Complaints**

Inadequate Ration Consumption

Weight loss (both voluntary and involuntary) is quite common in the field. Soldiers often eat 20-40 percent less in the field due to the change from their normal routine, becoming bored with field rations after a few days, not having enough time to eat, etc. If this low food intake is not prevented, body weight loss can quickly reach a level where it impairs physical and mental performance. Weight losses of as little as two percent of pre-field body weight may negatively influence performance. Even if soldiers are overweight, the lower food intake may have a negative impact on performance.

Dehydration

Soldiers who do not consume enough fluids to replace those lost from sweating and urination become dehydrated and constipated. Even mild dehydration affects performance, reduces the desire to eat, and causes lethargy. Moderate dehydration leads to diminished work capacity, and more severe dehydration may result in severe disability or even death.

Monotony with Rations

Soldiers often become bored with 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.

Gastrointestinal Complaints

When in the field, military personnel periodically complain of gastrointestinal upsets such as diarrhea or constipation when in the field. 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 Ration Consumption

1. Soldiers must be taught that adequate consumption of food and water are tactical weapons and how eating and drinking 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 which 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. Control use of pogey bait and other non-issue food. Do not allow pogey bait to be used as substitutes for more nutritious meals or rations. These items can be useful supplements to provide extra calories, but they cannot be considered as a replacement for nutritionally

complete foods. 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.

6. Encourage soldiers to eat at least part of all 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.

7. Establish regularly scheduled meal times 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.

Maintain Adequate Hydration

1. Leaders should establish a program of regularly scheduled, enforced drinking in order to prevent dehydration. In general, most soldiers need to drink at least four canteens of water per day (and considerably more when working in the heat).

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. Eating too much salt (sodium) may lead to dehydration. Excess salt intake increases the body's water requirements since a person must drink more water to excrete the extra salt.

4. Monitoring the color of one's urine helps determine who may be getting dehydrated. Dark yellow urine indicates inadequate fluid intake; fluid consumption should be increased until urine turns pale yellow.

5. Appendix D provides additional advice about the signs and symptoms of dehydration and what to do if dehydration occurs.

Prevent Ration Monotony

1. 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 a T Ration, B Ration or A Ration; all three can be equally effective.

2. 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.

3. Work with logistical support personnel to insure that a variety of food items are made available to personnel. For example, there are 10 different tray ration breakfast menus and 10 different dinner menus. Be sure the variety available is obtained and served. Obtaining locally procured supplements such as fresh fruit or beverages can be helpful (make sure a food service sanitation 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.

Gastrointestinal Complaints

1. Appendix D provides advice for dealing with common gastrointestinal complaints encountered in the field.

2. Assume all native foods are contaminated and might cause gastrointestinal illness. An appropriate food service sanitation officer must inspect all locally procured foods. Prepare any locally obtained foods in a facility with the resources to guarantee wholesomeness and disinfection.

PRE-DEPLOYMENT PREPARATIONS

Eating well in garrison prepares the body to be healthy and physically fit to endure any condition encountered in the field. See Appendix A for general information on Garrison Nutrition.

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. The goal should be to select nutritious pogey bait (instead of empty calorie snacks) that can improve a person's diet in the field

Carbohydrate is the body's most accessible fuel source for physical performance. Carbohydrate stores in the body become depleted quickly. Eating high-energy foods helps replenish the body's stores of carbohydrate (glycogen stores). 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. The following items provide good complex carbohydrate snacks:

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

High-fat foods such as nuts, cheese, jerky, sausages, and empty-calorie candy 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.

"Sport" bars and drinks may seem to be ideal snacks but actually are just more expensive, and yet no more nutritious, than common items available in the commissary or grocery store.

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 provides 1/3 of the Military Recommended Dietary Allowances (MRDA). 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 dairy nutrients. *See Tables 1 through 3 in Appendix B for nutrient information of specific ration components.*

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 (until rehydrated) 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) !mmersing 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 yukon stove

6. Do dehydrated foods increase my water requirements?

a. 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.

b. Water requirements for reconstituting different rations when using a 1 quart canteen:

1) One MRE requires about ½ canteen to hydrate all components (i.e., three MREs would require about 1½ canteens of water).

2) The RCW requires about 3 canteens to hydrate all the ration components (about ½ canteen for each main entree alone).

3) The LRP requires about 1 canteen to hydrate all components (i.e., three LRP-I's 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 enforce 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.

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

KEY ISSUES

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

Dehydration

1. 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 1.5 quarts per hour or more are not unusual and are higher when soldiers wear chemical protective clothing. Failure to adjust work/rest cycles to control the build-up of body heat and failure to replace fluid lost through sweating, can lead to dehydration. This, in turn, increases an individual's susceptibility to heat injury/illness.

2. 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 and after 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

1. 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.

2. Military personnel living and working in temperatures ranging from 86 to 104°F (30 to 40 °C) may require up to 10 percent more calories to do the same amount of work as they would under more temperate conditions. Inadequate food intake results in body weight loss which can eventually impair physical and mental performance. Poor food intake decreases the intake of salt necessary to retain water.

3. Food is also a source of water and can account for up to 10% of total fluid intake. **Almost 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/illness by causing nausea, vomiting, diarrhea, and fever. Hence, command emphasis on proper field hygiene and sanitation techniques is critical.

MANAGING THE KEY ISSUES

Maintain Adequate Hydration

1. Adjust fluid intake and work/rest cycles as temperature varies. 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. Ten to twelve quarts of water per day will be required by military personnel working in hot environments Under extreme heat, especially

in an environment in which chemical protective clothing is worn, water requirements may increase to as much as 28 quarts per day (7 gallons). However, eighteen quarts is about the maximum amount of water that can be drunk and absorbed by the body in 18 waking hours. It is imperative that commanders consider the amount of water necessary at different environmental temperatures to support the corresponding work/rest schedules.

2. Enforce routine water consumption. Soldiers need to drink even when they are not thirsty. It is best to plan and enforce a schedule for drinking. A suitable drinking schedule, for an average-sized soldier working in moderate heat, would be to drink one liter of water in the morning, one liter at each of three meals, and routinely drink small amounts (two cups every 30 min) throughout the work period. **Remember, it is much better to drink small amounts of water frequently than to drink large amounts occasionally**. Following a schedule may seem tedious but in the long run will help soldiers drink more. This will reduce the likelihood of soldiers becoming heat casualties in addition to preserving their physical performance capabilities.

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, however, flavored, cool water is voluntarily consumed in larger amounts than plain, warm water. 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). Beverages can be cooled by shading, insulating, and camouflaging water buffaloes or by using small mobile chillers. Drinking alcoholic or caffeinated beverages may increase urination and the tendency for dehydration.

4. Monitor soldiers for signs of dehydration.

a. Monitor the color and volume of the urine of soldiers. If urine is dark yellow or brown and less than normal, soldiers are probably dehydrated. Have soldiers drink 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 (see Appendix D).

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/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. 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 meal per day), additional salt in the form of a very dilute salt solution may be necessary. This solution can be made by adding one-fourth teaspoon table salt (1/4 MRE salt packet) to each quart of drinking water. Salt tablets should never be used without recommendation and monitoring by a medical officer since they can easily be consumed in excess of sodium needs and actually contribute to dehydration by increasing water requirements.

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 are stored with water. When these carbohydrate stores are burned during physical activity, metabolic water is produced. This metabolic water can then be used by the body to help replace water lost through sweating. 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. Avoid eating uncooked or peeled fresh fruits and vegetables in underdeveloped countries, where produce, especially lettuce and fruits, is frequently grown in soil contaminated with human excrement (night soil) and may cause diarrheal disease.

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

1. Does the body's thirst mechanism tell people whether they are drinking enough fluids?

No, thirst alone is not a good indicator of adequate fluid intake because an individual's thirst mechanism becomes dulled during and after vigorous activity. Some of the physical signs of dehydration are: absence of urination, deep orange or brown concentrated urine, lack of appetite, vague discomfort, lethargy, weariness, sleepiness, and apathy. Remember, soldiers will always need to drink before they feel thirsty.

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 replacement fluid 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 component/foodstuffs 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 eight 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 under most circumstances contain adequate amounts of salt, additional salt may be lightly added to food during the first few days of heat acclimatization using the salt packets provided with the rations. Remember, however, that excessive salt intake without adequate water intake will lead to dehydration.

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 monitor the color and volume of urine of soldiers 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 when operations are in underdeveloped countries.

NUTRITIONAL ADVICE FOR 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 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 lac[illegible]al 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. People who are dehydrated "feel the cold" more keenly than well-hydrated individuals. Dehydration can reduce appetite, impair the shivering response, and lead to lethargy and low energy levels. Lethargy is not a desirable physical state in the cold since physical activity is necessary to generate heat.

High Energy Requirements

Calorie requirements of military personnel can be 25-50 percent higher during cold-weather operations than in warm or hot weather. 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 A, B, or T Rations should be prepared and served hot. Individual rations such as the MRE, LRP, or RCW can be heated using the Yukon 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, enforced drinking.

a) Soldiers should drink at least 5-6 canteens of water each day.

b) Schedule drinking at hourly intervals. One-half canteen consumed each hour results in four canteens of water consumed over an eight hour day. This, in addition to drinking one-half canteen with meals and with an evening snack insures consumption of the recommended quantity of fluids each day.

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 frequent urination, dehydration, and difficulty sleeping, depending upon individual tolerances. 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 accelerates body heat loss (by bringing more blood to the surface of the skin) and can impair judgement.

6. Avoid consuming excess salt (more than that normally provided in the military rations). Excess salt increases the body's water requirements since a person must drink more water to excrete it. Excess salt consumption without adequate water intake will lead to or aggravate dehydration.

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 food consumption by approximately 25-50 percent, depending on their activity level, to meet the extra energy requirements of cold weather operations. For example, in garrison an average male burns 3200 Calories/day and an average female burns about 2400 Calories/day. The energy requirement may increase to approximately 4500 Calories/day for males and 3500 Calories/day for females when participating in cold weather field training. The RCW was 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 and "throw off" the body's ability to produce energy for work.

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/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 2400 Calories/day for females and 3200 Calories/day for males. Work in the cold may require 4000-5000 Calories/day. A day's worth of military issue cold weather rations is designed to provide 4500 Calories. (Three MREs total 3990 Calories, three LRPs total 4710 Calories, one RCW contains 4500 Calories, and a typical T Ration meal with the cold weather supplement provides 1500 - 2000 Calories.)

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. Avoid high-protein and salty snacks since they can contribute to dehydration. Commercially purchased snacks may also be appropriate but are costly and no more effective than military rations. 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 T ration food items high in carbohydrate are bread, crackers, fruits, potatoes, rice, 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 Arctic T Ration Module with the cold weather calorie supplement and the MRE. The military does have a 4500 Calorie dehydrated packaged field ration (the Ration, Cold Weather) available for missions requiring rations with minimum weight and bulk.

7. Do dehydrated foods increase water requirements?

Yes and no; more water is needed to prepare (hydrate) the food items in the dehydrated Ration, Cold Weather compared to the MRE due to differences in their moisture content. However, the body's total daily water requirement will not be different. In one case, water must be added to the food; in the other case, the food already has water in it. 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.

DOs AND DON'Ts FOR COLD WEATHER NUTRITION

DO eat 25-50% 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.

DO moderate coffee and caffeine consumption.

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

1. Eating enough food is the most important nutritional factor at altitude. Almost all persons going to altitude lose weight. 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.

2. Energy requirements for high-altitude operations are increased 15 to 50 percent 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 6000 Calories per day.

3. Although energy expenditures increase, food intake usually decreases due to lack of appetite, limited availability of food, and difficulty in food preparation. During the first three to four days at high altitude, the headache, nausea, vomiting and pronounced anorexia of acute mountain sickness (AMS) interfere with food and fluid intake. Even after the symptoms of acute

mountain sickness subside, appetite remains depressed and it takes less food to reach a feeling of fullness - the higher the altitude, the greater the appetite depression.

4. 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.

5. Women seem to have a biological advantage at altitude. Women, in general, suffer less severe symptoms of AMS and do not experience as great a depression in appetite and food intake as do their male counterparts.

6. 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.

Inadequate Carbohydrate Intake

1. Carbohydrate is the preferred energy source at altitude. Carbohydrates replace depleted muscle glycogen stores, prevent protein being used as energy, and require less oxygen for metabolism. A high-carbohydrate diet can reduce the onset and severity of AMS and improve physical performance and mental efficiency. 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.

2. 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.

3. 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

1. It is easy to become dehydrated in high-altitude environments. Dehydration increases the risk of cold injury; and exacerbates the fatigue, impaired judgement and apathy, of hypoxia. The body's requirement for fluids is very high at altitude; often exceeding four liters of water per day. This is mainly caused by increased 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.

2. 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 include headache, nausea, vomiting, and the loss of appetite.

3. 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 (it takes 40 minutes to melt four cups of snow to make one cup of water).

4. All melted snow and ice, as well as water from streams, should be considered contaminated. Because at altitude water boils before it reaches 212°F (100°C), the boiling temperature of water at sea level, it needs to be boiled for a longer period than the ten minutes necessary for sterilization at sea level. This amounts to an additional minute for every 1000-foot gain in altitude. For example, at 14,000 feet, water needs to be boiled for 24 minutes to be purified.

Gastrointestinal Complaints

1. 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. Emphasis on adequate fluid intake is the best preventative.

2. 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 Calories per day. This can be met by providing four Meals, Ready-to-Eat if no other rations are to be provided. One Ration, Cold Weather (RCW) or three Food Packets, Long Range Patrol (LRP) would also meet the daily calorie allowance. The RCW requires about 3 quarts to rehydrate all food components. Three LRPs require about 3 quarts to rehydrate all components. The Ration, Lightweight (RLW-30) is a high-fat ration that is not appropriate for high-altitude operations.

b. Items from the Cold Weather Ration Supplemental Module (excluding the Nut Raisin Mix) can provide high-carbohydrate foods to enhance energy, carbohydrate, and fluid intakes of soldiers subsisting on A, B, or T 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, force 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 T ration cakes (except pound cake), crackers, Fig Newtons, 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 altitude and can worsen the symptoms of AMS. Fat requires more oxygen for metabolism than 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. 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. Establish a program of regularly scheduled, enforced drinking. Soldiers must be reminded to drink even when they are not thirsty. A scheduled intake of one canteen of water every three hours is recommended so that **at least 5 quarts of water** are consumed each day. If the training schedule prevents frequent stops to drink, at least 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 noncaffeinated beverages. Warm fluids are well received in cold temperatures. However, tea and coffee have a diuretic effect and promote fluid loss. In addition, excess caffeine can interfere with sleep that 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. An exception to the limitation of caffeine is when treating the incapacitating high-altitude headache. Many climbers successfully use a double strength mug of coffee to relieve the headache.

3. Monitor the color and volume of soldiers' urine to check for dehydration. If urine is dark yellow or brown or less than normal, the soldier is probably dehydrated. Soldiers should drink until their urine turns pale yellow in color.

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. Soldiers generally need at least **four to six quarts** of fluid per day when at altitude because of the extremely dry air. 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 terrains. 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.

DO plan for 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 noncaffeinated 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.

APPENDIX A

GARRISON ENVIRONMENT

The nutritional 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

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

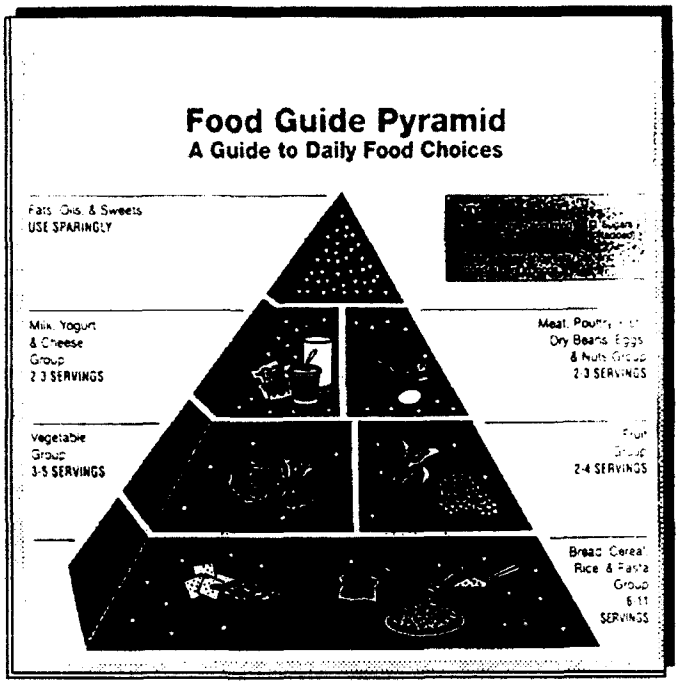
Dietary Guidelines for Americans

Making informed choices about the kind of foods one eats helps insure obtaining the body's requirements for nutrients. The Dietary Guidelines for Americans provides guidance on what to eat to stay healthy. The dietitian at the installation hospital or in the local community can provide detailed descriptions and information on implementing the various guidelines (see appendix E).

DIETARY GUIDELINES

1 - Eat a variety of foods
2 - Maintain healthy weight
3 - Choose a diet low in fat, saturated fat, and cholesterol
4 - Choose a diet with plenty of vegetables, fruits, and grain products
5 - Use sugars only in moderation
6 - Use salt and sodium only in moderation
7 - If you drink alcoholic beverages, do so in moderation

* **Eat a Variety of Foods** - Individual food items vary in nutrient content and no one food contains all the nutrients needed for good health; thus, individuals must eat a variety of foods to get all the nutrients needed. One way to assure variety is to choose foods each day from the major food groups as depicted in the Food Guide Pyramid. Appendix C provides a table describing the major nutrient requirements, functions, and some of the best sources of each.



* **Maintain Healthy Weight** - For persons above their healthy weight, moderately decreasing food intake and increasing exercise will help. A steady weight loss of 1/2 to 1 pound per week is recommended for safe weight loss.

* **Choose a Diet Low in Fat, Saturated Fat, and Cholesterol** - In general, to eat a diet low in fat, saturated fat, and cholesterol: 1) Eat plenty of vegetables, fruits, and grain products, 2) Choose lean meats, fish, or poultry, 3) Choose low-fat dairy products, and 4) Use fats and oils sparingly.

* **Choose a Diet with Plenty of Vegetables, Fruits, and Grain Products** - These foods provide complex carbohydrates, dietary fiber, and other food components linked to good health. Dietary fiber is important for proper bowel function; and may be beneficial in preventing heart disease, obesity, and some cancers. Also the foods are low in fat.

* **Use Sugars Only in Moderation** - Sugars and many foods that contain them in large amounts supply calories but are limited in nutrients. Excessive and frequent intake of these "empty calorie" sugar foods contributes to tooth decay. Regular daily brushing helps reduce the tooth decay formation but still does not make high-sugar foods a good idea as a major source of one's daily calories.

* **Use Salt and Sodium Only in Moderation** - Table salt is made of sodium and chloride. Sodium helps our body maintain proper fluid balance. 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 the salt added to foods and consumption of processed, high-salt foods (read food labels).

* **If You Drink Alcoholic Beverages, Do So in Moderation** - Alcoholic beverages supply calories but few nutrients. Drinking has no health benefit but is linked with many health problems. It is also 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.

APPENDIX B

Table 1. Basic Nutrient[1] Information on Rations

Nutrient	Unit	Standard[2]	Group Rations			Individual Rations	
			A	B	T	MRE XII[3]	GTW[3]
Energy	kcal	3600	3371	4290	3600	[illegible]	3837
Protein	g/%	100/*11*	145/*17*	144/*13*	156/*16*	148/*15*	139/*14*
Carbohydrate	g/%	440/*50-55*	403/*51*	579/*54*	440/*55*	502/*50*	537/*56*
Fat	g/%	160/≤*40*	121/*32*	157/*33*	131/*29*	161/*36*	138/*32*
Vitamin A	IU	5,000	17,230	7,907	7,092	10,851	8,130
Vitamin C	mg	60	197	93	285	306	106
Calcium	mg	800	1,894	1,048	1,467	1,539	1,740
Iron	mg	18	18	26	25	18	17
Sodium	mg	5,000-7,000	5,491	*	6,963	5,469	5,370

[1]Nutrients provided per day, that is, a combination of breakfast, lunch and dinner meals.
[2]Nutritional standards for operational rations (what a ration must contain). There are no "requirements" for carbohydrate and fat. The value given for fat is the maximum amount that should be consumed per day; the value for carbohydrate is a "suggested" value. Higher levels are permissible. These are different from the MRDAs which are the nutritional recommendations for service members (what to consume).
[3]Three meals per day, i.e., 3 MREs or 3 Go to War rations (GTW) per day.
*Data not available.

Table 2. Basic Nutrient[1] Information on Restricted Rations

Nutrient	Unit	Standard[2]	Restricted Rations		
			RLW[4]	LRP[5]	GP[6]
Energy	kcal	1100-1500	2132	1556	1544
Protein	g/%	50-70/*15*	71.6/*13*	59.7/*15*	18.5/5
Carbohydrate	g/%	100-200/≥*46*	202/*38*	195/*50*	221/57
Fat	g/%	50-70/≤*42*	115/*49*	60/*34*	66/*38*
Vitamin A	IU	2,500	3,555	1,215	1,607
Vitamin C	mg	30	127	61	0
Calcium	mg	400	995	383	132
Iron	mg	9	30	8	5
Sodium	mg	2,500-3,500	3,588	2,580	2,366

[1]Nutrients provided per day; one ration.
[2]Restricted rations do not provide enough nutrients to meet the MRDAs.
[3]Nutritional standards for restricted rations (what a ration must contain
[4]Ration, Lightweight.
[5]Food Packet, Long Range Patrol.
[6]Food Packet, Survival, General Purpose.

Table 3. Nutrient Fortification in Rations

Ration Component	Vitamins						Minerals
	A	C	B_1	B_2	Niacin	B_6	Calcium
Cocoa Beverage Powder	x	x	x			x	
Cheese Spread	x	x	x			x	
Oatmeal Cookies Coating	x	x	x			x	
Brownies Coating	x	x	x			x	
Peanut Butter	x	x	x				
Crackers			x	x	x	x	x

B_1=Thiamin; B_2=Riboflavin; B_6=Pyridoxine

APPENDIX C
NUTRIENT FUNCTIONS AND SOURCES

NUTRIENT	MILITARY RECOMMENDED DIETARY ALLOWANCE[1]			FUNCTION	SOURCES		
		Male	Female		Garrison/A or B Rations	MRE	T Rations
Protein	g	100	80	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	Should contribute about 50-55% of the total daily energy intake.			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	Should contribute less than 35% of total energy intake.			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	About one milliliter of water per Calorie expended when doing light to moderate activity in temperate climate.			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
Calcium	mg	800-1200	800-1200	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	mg	800-1200	800-1200	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	mg	350-400	300	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

NUTRIENT	MILITARY RECOMMENDED DIETARY ALLOWANCE[1]			FUNCTION	SOURCES		
		Male	Female		Garrison/A or B Rations	MRE	T Rations
Iron	mg	10-18	18	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	mg	15	15	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	mg	<1700 mg per 1000 Calories	<1700 mg per 1000 Calories	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	mg	1875-5625	1875-5625	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
Vitamin C	mg	60	60	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 B1 (Thiamin)	mg	1.6	1.2	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 B2 (Riboflavin)	mg	1.9	1.4	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	mg NE[2]	21	16	Work with thiamin & riboflavin for energy production	Liver, tuna, poultry, enriched bread & cereals, meat, nuts, dried p as & beans, pasta	Entrees, crackers	Entrees, bread

NUTRIENT	MILITARY RECOMMENDED DIETARY ALLOWANCE[1]			FUNCTION	SOURCES		
		Male	Female		Garrison/A or B Rations	MRE	T Rations
Vitamin B6 (Pyridoxine)	mg	2.2	2.0	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	mcg	400	400	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 A	mcg RE[3]	1000	800	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	mg TE[4]	10	8	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
Vitamin B12	mcg	3.0	3.0	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

1 Military Recommended Dietary Allowance (MRDA) - The daily essential nutrient intake levels presently considered to meet the known nutritional needs of practically all 17- to 50-year old, moderately active military personnel. The MRDA are based on the National Academy of Sciences/National Research Council publication Recommended Dietary Allowances, 9th revised edition, 1980.

2 Milligram of niacin equivalent (equals 1 milligram of niacin or 60 milligrams dietary tryptophan)

3 Microgram of retinol equivalent (equals 1 microgram of retinol, 6 micrograms beta carotene, or 5 International Units)

4 Milligram of alpha-tocopherol equivalent (equals 1 milligram d-alpha-tocopherol)

Abbreviations: g - gram mg - milligram mcg - microgram

APPENDIX D
COMMON NUTRITION-RELATED MEDICAL COMPLAINTS

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:

1. Poor personal hygiene (transmission of bacteria by unwashed hands, utensils, etc.)
2. Allergies
3. Intestinal virus
4. Food poisoning
5. Dysentery
6. Emotional stress
7. Excessive drinking of alcohol

Symptoms

1. Frequent loose and watery stools
2. Stomach cramping
3. Tiredness (due to loss of potassium)
4. Thirst (due to fluid loss)
5. 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, Gatorade-type 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.

DEHYDRATION

Definition 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.

Causes mainly involve weather factors along with physical exertion, combined with not replacing lost fluids. Dehydration could also be caused by illnesses involving diarrhea/vomiting.

Symptoms depend on the percent body weight lost due to dehydration. Fluid loss resulting in as low as 2% loss of body weight can compromise physical performance. A 3-5% loss in body weight leads to a diminished work capacity while a 10-15% 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).

Symptoms of dehydration as percent of body weight loss

1 - 5%	6 - 10%	11 - 20%
Thirst	Dizziness	Delirium
Vague discomfort	Headache	Muscle spasms
Economy of movement	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 and Prevention 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 6-10% range and higher), it should be treated as an emergency by seeking prompt professional medical attention, including IV fluid replacement.

Prevention techniques include ingestion of adequate water prior to working in the heat. For example, drinking 13 to 20 ounces of water (preferably cold) beforehand will delay dehydration. While working, up to two quarts of fluid may be needed per hour to help prevent dehydration. This can be accomplished best by drinking about 8 ounces (1 cup) of fluid every 10-15 minutes. There are instances where this is not enough fluid to replace sweat losses, but it is the most that can be emptied from the stomach in an hour (more plain water can be absorbed per hour than flavored drinks). Therefore, even when the maximum amount of fluid is drunk, in some conditions it is necessary to still watch for signs of dehydration because it will be impossible to maintain adequate hydration. When performing hard physical work in hot environments, it is important to refer to and adhere to work/rest guidelines. Work/rest cycles help fluid absorption keep pace with fluid loss.

CONSTIPATION

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

Causes include:

1. Dehydration
2. Fiber deficient diets
3. Rectal diseases
4. Diseases of the colon
5. Lack of exercise (decreases intestinal muscle tone)
6. Abrupt living habit changes
7. Drugs (e.g., analgesics, antacids)
8. 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 nut cakes, peanut butter, beef stew, tuna noodles, and chicken stew. If constipation persists, contact a medical doctor.

CARBOHYDRATE DEPLETION

Definition The lack of sufficient carbohydrate stores in living muscle and/or blood, usually due to inadequate intake of dietary carbohydrate.

Causes

1. Inadequate intake of dietary carbohydrate
2. Prolonged heavy exercise

Symptoms that may appear: muscle fatigue (which increases the risk of injury), lightheadedness, decreased endurance, inability to think clearly, weakness, and hunger.

Treatment and Prevention: 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.

APPENDIX E

FOR FURTHER READING

The following references are provided for those desiring additional information. Installation publications office or library should be able to assist in obtaining any of these materials.

Nutrition/Field Feeding Publications

1. Department of the Army, AR 40-25, Nutrition Allowances, Standards, and Education
2. Department of Defense, DODD 1338.10, DOD Food Service Program
3. Department of the Army, AR 30-1, The Army Food Service Program
4. Department of the Army, FM 10-23, Army Food Service Operations
5. Department of the Army, FM 10-23-1, Commander's Guide to Food Service Operations
6. Department of the Army, AR 30-7, Operational Rations
7. US Army Natick Research, Development, & Engineering Center, Natick, MA, Natick Pam 30-2, Operational Rations of the Department of Defense
8. Department of the Army, AR 40-656, Veterinary Surveillance Inspection of Non-perishable Foods
9. Department of the Army, AR 40-657, Veterinary/Medical Food Inspection
10. Department of the Army, TB MED 530, Food Service Sanitation
11. Department of the Army, FM 21-10, Field Hygiene and Sanitation
12. Department of the Army, TB MED 577, Sanitary Control and Surveillance of Field Water Supplies

High-Altitude Environment References

1. Lickteig, Julie Ann. Nutrition for high altitudes and mountain sports. in Casey, MJ., Foster, C., and Hixson, E.G. (Eds) Winter Sports Medicine. Philadelphia: F.A. Davis Co. 1990.

2. Gunn, C. The Expedition Cookbook. Denver: Chockstone Press. 1988.

3. Department of the Army. TB MED 288. Medical problems of man at high terrestrial elevations. 15 October 1975.

Garrison References

1. Nutrition and Your Health: Dietary Guidelines for Americans, 3rd Ed. U.S. Department of Agriculture and U.S. Department of Health and Human Services, 1990.

2. Eat for Life: The Food and Nutrition Board's Guide to Reducing Your Risk of Chronic Disease. Woteki, C.E., and Thomas, P.R., Eds. Institute of Medicine, National Academy of Sciences, 1992.

3. Surgeon General's Report on Nutrition and Health. Public Health Service, U.S. Department of Health and Human Services, 1988.

4. Diet and Health: Implications for Reducing Chronic Disease Risk. National Research Council, National Academy of Sciences Recommended Dietary Allowances, 10th Ed. National Research Council, National Academy of Sciences, 1989.

5. Fit to Win: Your Handbook (The Army Health Promotion Program). Department of the Army Pamphlet 600-63-14. SEP 1987

6. Fit to Win: Nutrition & Weight Control (The Army Health Promotion Program). Department of the Army Pamphlet 600-63-6. SEP 1987

7. Nieman, D.C. Fitness and Sports Medicine: An Introduction. Palo Alto, CA: Bull Publishing Co., 1990.

Cold References

1. Askew, E.W. Nutrition and performance under adverse environmental conditions. In: Nutrition in Exercise and Sport. CRC Press, Boca Raton, FL, 1989, pp. 367-384.

2. Askew, E.W. Nutrition for a cold environment. Phys. Sportsmed. 17:77-89, 1989.

Heat References

1. _____Nutritional Needs in Hot Environments, Applications for Military Personnel in Field Operations. Bernadette M. Marriott, Ed., National Academy Press, 2101 Constitution Ave. NW, Washington, D.C. 20418, 1993.

2. _____Fluid Replacement and Heat Stress. Proceedings of the Committee on Military Nutrition Research, Bernadette M. Marriott and Connie Rosemont, Eds. National Academy Press, 2101 Constitution Ave. NW, Washington, D.C. 20418, 1992.

For Assistance with Education Programs on Nutrition

Installation Contacts: Hospital Dietitian, Food Service NCO, Food Service Officer

Local Community Contacts: County Extension Home Economist (Cooperative Extension System), Public Health Department Nutritionist, American Red Cross, American Dietetic Association, American Heart Association, or Cancer Society