NUTRITIONAL GUIDANCE

For Military Field Operations
in Temperate and Extreme Environment

Prepared by
C.D. Thomas, C.J. Baker-Fulco, T.E. Jones,
N. King, D.A. Jezior, B.N. Fairbrother, K.L. Speckman, E.W. Askew

US Army Research Institute of Environmental Medicine
Natick, Massachusetts 01760-5007

TABLE OF CONTENTS

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. More detailed information on the subject matter covered in this pocket guide can be found in USARIEM Technical Note 93-3, Nutrition for Health and Performance - Nutritional Guidance for Military Operations in Temperate and Extreme Environments, February 1993 (AD 261392).

Readers are encouraged to provide critical comments and examples of their own "lessons leaned" about field feeding for military personnel to:

COMMANDER
US Army Research Institute of Environmental Medicine
ATTN: SGRD-UE-OPN (Military Nutrition Division)
Natick, MA 01760-5007

Telephone: DSN 256-4811 FAX: DSN 256-5298
Commercial (508) 651-4811 or 5298
E-Mail Address: Commander@NATlCK-ILCN.ARMY.MIL

INTRODUCTION

Nutrition is 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 ensure 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 the field as well as in garrison. In addition, leaders should set the example for their troops by practicing "fit to win" eating habits.

This pocket guide provides guidance for achieving proper nutrition in field environments (with emphasis on the "problem" environments of cold, heat, and high altitude). Soldiers performing physically demanding field missions are especially receptive to information on diet and physical performance. This guide 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.

BACKGROUND

Under certain conditions, such as work performed in extreme environments (heat, cold, and altitude), the physical demands of performing military duties approach, or may even exceed the physical demands of training that endurance athletes experience. Athletes know that to maximize their performance, it is not enough that they train specifically but it is just as important that they apply the principles of proper nutrition. It is critical to the accomplishment of the

mission that soldiers understand the relationship between sound nutritional practices and the body's ability to meet physical challenges.

In order to perform work, the body needs a constant supply of energy. This energy comes from the food we eat in the form of calories (kcal). Carbohydrate, protein, and fat are the fuel sources for producing energy for muscular contractions. Additionally, while carbohydrate is the predominant fuel for muscles during intense exercise or activity, it is the least abundant nutrient stored in the body (fat is the most abundant). Carbohydrate is stored in the liver and muscles as glycogen, and in the blood as glucose; however, these stores are limited. For example, 2 hours of exercise or 8 hours of fasting significantly deplete these stores, and it takes a minimum of 20 hours to replenish them. Soldiers who habitually eat a high-carbohydrate diet recover muscle glycogen stores daily which, in turn, allows them to continue to perform at high levels of intensity. See Figure 1[1]. Eating a low carbohydrate diet does not allow the body to recover to its pre-exercise glycogen level before the next bout of activity. Soldiers can maximize glycogen replenishment by consuming carbohydrates within 30 minutes of completing intense activity. They can also enhance recovery by eating small carbohydrate snacks while working. For the reasons outlined above, the recommended diet for soldiers is a carbohydrate intake of 5-6 grams/kilogram of body weight per day, an amount which represents 60-65% of total daily calories. By contrast, protein requirements only comprise 12-15% of total daily calories which represent an intake equivalent to 1-2 grams/kilogram of body weight per day. Consuming protein in excess of the amount needed for tissue growth and repair results in the body converting it into fat. If however, the body lacks sufficient supplies of carbohydrate and fat, it breaks down protein to produce energy. Soldiers must therefore increase their caloric intake (in particular carbohydrates) to spare protein catabolism, and the subsequent loss of muscle tissue. Although protein is crucial to the building and repairing of body tissue, it is not a primary source of energy because it is not a readily available source. Fat is not a primary source of energy for high intensity work (although it is a good source of calories: fat=9 kcal/gram vs. protein and carbohydrate=4 kcal/gram) since energy released from fat metabolism occurs at a much slower rate than energy released from carbohydrate metabolism. Fat requirements for energy and essential fatty acids can be met when fat composes 20-25% of total daily caloric intake. Additional nutrients which do not supply energy but that are important to normal body functions are vitamins, minerals (electrolytes), and water.

Vitamins provide no energy although they are needed for various metabolic reactions. Vitamin supplements are usually unnecessary if the diet is adequate in all nutrients. Electrolytes are electrically charged minerals dissolved in body fluids (e.g., sodium, potassium, and chloride). They function to maintain fluid balance, blood volume, nerve transmission, muscular contraction, and to control acid and base balance. The body's electrolyte level decreases during sweating; this is one reason why rehydration is so important. Another reason for staying well-hydrated is the effect that dehydration has on performance: as little as a two percent decrease in body weight (due to water loss) can significantly decrease performance. Soldiers must be made aware that during periods of intense activity (especially in extreme environments), their water requirements increase. They must drink even when they don't feel thirsty since thirst sensation is a poor indicator of the need for fluids. In summary, as long as soldiers know the facts about proper nutrition, they have the knowledge to prevent injury or illness, to maximize their performance, and to ensure completion of the mission.

[1] Reproduced with permission from D.L. Costill and J.M. Miller, “Nutrition for Endurance Sport: Carbohydrate and Fluid Balance”, Int. J. Sports Medicine 1 (1980) 2-14. (High CHO diet = 70% CHO; Low CHO diet = 40% CHO)

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 depends upon the unit's mission, tactical scenario, location, and availability of food service equipment and personnel. This chapter provides an overview of ration design and development as well as 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, with guidance from the Office of the Surgeon General of the Army. 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 allows the items to be more compact or lightweight for ease of carrying.

RATION DESCRIPTIONS

Group Feeding Rations

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

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. This class of rations includes the **Meal, Ready-to-Eat (MRE)**, and the **Go to War Ration (GTW).**

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. The restricted rations are the **Ration, Lightweight (RLW-30)**, **the Food Packet, Long Range Patrol (LRP)**, and the **Food Packet, Survival, General Purpose Improved (GP-I).**

Specialty Rations

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

the Ration, Cold Weather (RCW), and the **Cold Weather T Ration.** See Table 1 for descriptions of all **types of military rations.**

TABLE 1
Military Ration Types

Group Feeding	Individual Ration	Restricted Ration	Specialty Ration
A Ration - Garrison feeding. Semi-perishable & perishable food items requiring refrigeration, food service equipment & personnel.	MRE- Basic operational ration. Heat processed food items requiring no preparation. Packed in flexible pouches.	RLW-30- For special missions up to 30 days. Dehydrated foods high in energy but restricted in calorie content.	RCW- For ops in extremely cold conditions. Freeze-dried, cooked entrees. Two meal bags/ration provides food for 24 hrs.
B Ration - Field feeding. Canned & dehydrated foods not requiring refrigeration.	GTW- "Back-up" ration for war or emergency situations. Shelf stable products packaged with two FRHs in a menu bag.	LRP- For initial assault & special ops of 10 days or less as one LRP/day isn't adequate in energy or nutrients. Pre-cooked, freeze-dehydrated food.	T Ration, Cold Weather- Includes a supplement module providing an additional 1020 cals/meal: pouch bread, soup, extra beverages, cookies & candy.
T Ration - Field ration. Ready-to-heat & serve, packaged in short, rectangular metal cans.		GP-I- Used for <5 consecutive days. Survival packet of six compressed bars: one sugar, two cereal, & three cookie.	

NUTRITIONAL ADEQUACY

1. Military Recommended Dietary Allowances (MRDAs) establish standards for the nutritional content of military rations. 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 A-1 in Appendix A). The Restricted Rations do not meet the MRDAs for some nutrients and

should not be consumed for indefinite amounts of time (see Table A-2 in Appendix A). Additional information about the functions, and food sources of nutrients can be found in Appendix B.

NUTRIENT FORTIFICATION OF OPERATIONAL RATIONS

It is important that soldiers know which ration components are fortified[2] with nutrients so they can make better food selections. Table A-3 (Appendix A) 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. See Appendix B for information on ration items that are natural sources of various nutrients.

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

POINTS TO REMEMBER:

♦ It is normal for fat to adhere to the surface of cold food and make it look higher in fat than it really is.

♦ Fat is a dense form of energy. One gram of fat provides 9 calories compared to 4 calories per gram (g) of carbohydrate or protein. Rations with some fat content can be small and compact because fat provides so many calories.

♦ MREs are within MRDA guidelines for sodium content. One MRE (less the salt packet) provides approximately 1800 milligrams (mg) of sodium. The usual sodium intake of soldiers in garrison is 3000-6000 mg per day. Therefore, MREs are not much higher in sodium than typical garrison intakes.

♦ Calculations of fiber content in rations indicate that relatively good sources of fiber include: pouch bread, fruits, peanut butter, potatoes augratin, stews, rice-containing entrees, nut cakes, cookies, and brownies. The fiber content of field rations, while not high, is adequate to prevent constipation. Insuring an adequate fluid intake is of greater importance in the prevention of constipation than the total fiber intake.

♦ Shelf life (the length of time that rations can be stored without losing nutritional value, wholesomeness and quality) 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.

♦ The U.S. military does not use irradiation (a process which applies radiation to food products to destroy parasites and germs that may cause the food to spoil) nor chemical preservatives to preserve ration items. Many military food items are preserved by a heat process called Thermostabilization. Rations also contain some natural food preservatives such as Vitamins C and E which are antioxidants.

NUTRITIONAL ADVICE FOR FIELD FEEDING

Food plays a major role in sustaining performance and morale in the field. Unit leaders must provide their soldiers with an adequate quantity of high quality food and ample time to eat it. 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. Chapters 3-5 provide nutrition information applicable in specific extreme environments (hot, cold, and high-altitude).

KEY ISSUES

Inadequate Ration Consumption

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

KEY ISSUES

- **Gastrointestinal Complaints**

Weight loss (both voluntary and involuntary) is quite common in the field. Soldiers often eat 20-40% less in the field due to the change from their normal routine, becoming bored with field rations after a few days, and not having enough time to eat, etc. If this inadequate food intake is not prevented, body weight loss can quickly reach a level where it impairs physical and mental performance. Weight losses of total body water of as little as two% of pre-field body weight may negatively influence performance. More severe weight loss can involve body water, fat, and muscle loss. Fat loss by itself does not compromise performance, but loss of body water and muscle mass can reduce strength and endurance. Even if soldiers are overweight, the lower food intake may have a negative impact on performance by reducing muscle glycogen stores, and by causing ketosis.

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 worsen the longer a field exercise or deployment lasts. This is particularly true if the sole source of food is always the same ration.

Gastrointestinal Complaints

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

MANAGING THE KEY ISSUES

Maintain Adequate Ration Consumption

1. Soldiers must be taught that adequate consumption of food and water are tactical weapons insofar as eating and drinking can affect their health and performance. Well disciplined and

trained troops generally ensure their own food consumption patterns are appropriate if they know 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 soldiers eat or discard.

4. Do not permit troops to use field deployments as a convenient way of dieting. Many military personnel have a misconception that field deployments are appropriate opportunities to lose weight. Morale and performance may suffer as a result of this impromptu dieting.

5. Control use of pogey bait and other non-issue food. Do not allow soldiers to substitute pogey bait 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 two to three times that 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. Salt tablets or other salt supplements are not necessary when soldiers eat military rations.

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 C 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. Ensure 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 because regaining soldier acceptance is difficult.

3. Work with logistical support personnel to ensure that soldiers receive a variety of food items. For example, there are 10 different tray ration breakfast menus and 10 different dinner menus. Be sure to obtain and serve the variety available. Obtaining locally procured supplements such as fresh fruit or beverages can be helpful (make sure a food service sanitation officer approves local procurement). 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 C 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. Locally obtained foods should be prepared in a facility with the resources to guarantee wholesomeness and disinfection.

PRE-DEPLOYMENT PREPARATIONS

The first point to keep in mind is, eating well in garrison prepares the body to be healthy and physically fit to endure any condition encountered in the field. Additionally, 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
Fig Newtons, hot chocolate, juices, hot and cold breakfast cereals,
instant mashed potatoes, rice, Cup of Noodles, Ramen,
bagels, toaster pastries, trail mix

Use high-fat foods such as nuts, cheese, jerky, sausages, and empty-calorie candy sparingly. A little of these foods is acceptable, but eating too much of these foods 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.

POINTS TO REMEMBER:

♦ Each ration meal provides 1/3 of the MRDA so soldiers should eat a variety of food items in the ration to ensure they get the required daily nutrients. See Tables A-1 through A-3 in Appendix A for nutrient information of specific ration components.

♦ Rations contain more than the MRDAs for vitamins so vitamin supplementation is not needed if soldiers eat the recommended three meals per day.

♦ Pogey bait can be a useful "nutritional supplement" to obtain extra calories and variety but it should not be used as a meal substitute.

♦ Wet-pack ration components. once opened. must be consumed within two hours. Dry ration components, until rehydrated, can be consumed within two days if protected from contamination by insects, rodents, dust, humidity, etc.

♦ The recommended ways of heating individual rations (depending upon tactical and logistical constraints) are: 1) flameless ration heaters, 2) immersing food pouches in hot water, and 3) heating tablets.

♦ 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.

TABLE 2
Water Requirements for Reconstituting Rations

Ration type	MRE	RCW	LRP

# of 1 quart canteens /ration	1½	3	1

1 Ration = 3 MRE's, 1 RCW, 1 LRP

DOs and DON'Ts for FIELD FEEDING	
DO emphasize food as a tactical weapon to maintain mental and physical performance.	**DON'T** assume that a ration issued is a ration fully consumed.
DO enforce water discipline.	**DON'T** allow soldiers to use field exercises as weight loss programs.
DO provide group/hot meals whenever possible; soldiers tend to eat more when eating "socially."	**DON'T** allow consumption of foods locally procured unless approved by food inspection officer.
DO schedule meal times when possible, even when individual operational rations are the planned meal.	**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

Dehydration

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

KEY ISSUES

- **Food-Borne Illness**

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 buildup 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, individuals normal thirst mechanisms do not stimulate them to 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 ensure 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 typically reduce their food intake by as much as 40 percent during field operations. Causes of inadequate food intake are: 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% 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. **Individuals consume almost half of all fluids at mealtimes.** If soldiers skip meals or voluntarily limit their food intake, then the amount of fluids consumed also decreases.

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. Soldiers working in **warm weather** require approximately **4 to 6 quarts of water per day** and need more water as physical work and temperatures increase. Military personnel working in **hot environments** require **10 to 12 quarts of water per day** . Under **extreme heat,** especially in an environment in which soldiers wear chemical protective clothing, water requirements may increase to as much as **28 quarts per day (7 gallons). However, 18 quarts is about the maximum amount of water that individuals can drink and the body absorb 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, is to drink 1 liter of water in the morning, 1 liter at each of three meals, and routinely drink small amounts (2 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 it helps soldiers to drink more. This reduces 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 the stomach easily empties it and absorbs it quickly into the rest of the body; however, individuals voluntarily consume flavored, cool water in larger amounts than plain, warm water. Nevertheless, almost any type of beverage consumed helps soldiers meet their water requirement (e.g., koolaid, juice, decaffeinated coffee, tea, soft drinks, lemonade, soups, milk). Cool beverages 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. Dark yellow or brown urine and less than normal amounts of urine indicate dehydration. 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) affects an individual's physical performance, mood, and the desire to eat, as well as increases the risk of heat injury or 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 C).

Maintain Adequate Food Intake

1. Encourage soldiers to eat at least two balanced meals per day. Individuals should not use the field as an opportunity to lose weight. Although depressed appetite and monotony reduce acceptance, personnel must consume their rations. 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 ensure adequate nutrition and salt intake. Failure to replace salt can lead to salt depletion, dehydration, nausea and vomiting, muscle cramps, or more serious problems. This can occur when soldiers are sweating and drinking, but not eating. Do not restrict water or beverage intake with meals or the amount of food consumed might also decrease. Commanders should monitor serving lines, watching to see what and how much soldiers eat, 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 8 days of heat exposure, especially if soldiers are not heat acclimatized, they should lightly season their meals with table salt. When food intake decreases drastically (e.g., only one meal per day), additional salt in the form of a very dilute salt solution may be necessary. This solution is made by adding 1/4 teaspoon table salt (1/4 MRE salt packet) to each quart of drinking water. Never use salt tablets without the recommendation of and supervision by a medical officer. Salt tablets consumed in excess of sodium needs 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, the body stores glycogen with water so burning glycogen during physical activity produces metabolic water. The body then uses this metabolic water 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) help individuals maintain proper hydration, enhance physical and mental performance, and prevent body weight loss.

<u>Avoid Water and Food-Borne Illness</u>

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

2. Do not add flavored beverages directly to canteens or bulk water storage containers.

Flavorings added to the canteen reduce the effectiveness of water disinfectants. In addition, soldiers may need canteen water for emergency hygiene (e.g., eye wash) or wound cleansing. All traces of flavorings must be rinsed out completely before disinfecting the next canteen of water. Mix flavorings in a canteen cup and drink completely after mixing.

3 Avoid eating uncooked or unpeeled fresh fruits and vegetables in underdeveloped countries, where produce, especially lettuce and fruits, grown in soil contaminated with human excrement (night soil) may cause diarrheal disease.

POINTS TO REMEMBER:

♦ Thirst alone is not a good indicator of adequate fluid intake so soldiers will always need to drink before they feel thirsty.

♦ Plain water is the beverage of choice. Glucose-electrolyte beverages may be useful under unusual conditions such as energy expenditure with restricted food intake.

♦ In hot weather, the amount of calories required actually increases slightly although the desire to eat goes down. Appetite suppression is a more serious problem in troops that are not heat acclimatized.

♦ Eating a variety of ration component/foodstuffs will help ensure sufficient vitamin intake.

♦ The amount of salt lost in sweat varies depending on a person's degree of acclimatization. As the body adjusts, or acclimatizes to the heat, sweat contains less salt. Military rations under most circumstances contain adequate amounts of salt but additional salt may be lightly added to food during the first few days of heat acclimatization using the salt packets provided with the rations.

♦ 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.	**DON'T** allow soldiers to become dehydrated.
DO maintain and enforce routine water and food discipline.	**DON'T** eat foods that are salty or high in protein if water is not available.
DO provide adequate quantities of sanitary, palatable water.	**DON'T** use the deployment to a hot environment as an opportunity to start a diet.
DO monitor the color and volume of urine of soldiers to check for dehydration.	**DON'T** skip meals.

DO's AND DON'Ts FOR HOT WEATHER HYDRATION AND NUTRITION

DO monitor weight loss if possible.	**DON'T** consume unsanitary ice.
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.	**DON'T** add flavorings such as beverage base, glucose-electrolyte powder or other commercial drinks directly to a canteen or bulk water storage container.
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** 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

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 ally often overlooked against the cold. Remember that food ultimately fuels the heat-generating shivering response. A lack of critical

metabolic fuels (carbohydrate, protein, and fat) limits shivering.

Dehydration

Military personnel often become dehydrated during cold weather operations. **Problems with frozen water and eating field rations (lower in water content than most garrison foods) contribute to reduced fluid intake in cold weather operations. 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.**

KEY ISSUES

- **Hypothermia**
- **Dehydration**
- **High Energy Requirements**

High Energy Requirements

Calorie requirements of military personnel can be 25-50% 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 © the body's physical mechanisms (i.e., shivering) and increased physical activity 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 often decrease 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 ensure 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 improves morale and satisfies 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. Prepare group rations (such as A, B, or T Rations) and serve hot. To heat individual rations (such as the MRE, LRP, or RCW) use the Yukon stove, heat tabs, flameless ration heaters, etc.

3. Eating regular meals and hearty snacks at 2 hour intervals throughout the day 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 helps 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 five to six canteens of water each day if active. Sedentary activities in the cold require about four canteens of water per day.

b) Schedule drinking at hourly intervals. One half canteen consumed each hour results in four canteens of water consumed over an 8 hour day. This, in addition to drinking one half canteen with meals and with an evening snack ensures 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 of fluids drink 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 is 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 is detrimental in the harsh cold. Drinking alcoholic beverages accelerates body heat loss (by bringing more blood to the surface of the skin) and impairs 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 leads to or aggravates 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%, 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. Eating a RCW and the T Ration with the Arctic supplement meet the higher caloric requirements of cold weather training.

2. Eating “normal” breakfast, lunch, and dinner meals with frequent nutritious snacks during the day and a small "snack meal" right before bedtime meets the high caloric demands of cold weather operations. Save extra foods from meal times to eat for midmorning, 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. Discourage military personnel from using field training exercises in cold weather as an opportunity to lose weight. Dieting compromises the body's ability to prevent hypothermia and decreases job performance (both mentally and physically).

4. Personnel may hear many anecdotal stories alleging that high-fat diets or foods are especially beneficial to helping the body tolerate the cold. While some of these stories have some basis in scientific fact, what the body really needs is 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 do not work so well for those accustomed to the more moderate fat content of the typical western diet. The human body adapts remarkably well to high-fat diets but this takes time (weeks). Greatly changing normal dietary patterns result in gastrointestinal and bowel problems and interfere with the body's ability to produce energy for work.

POINTS TO REMEMBER:

♦ Cold weather does not directly increase the body's -requirements for vitamins or minerals. A well-balanced diet that includes adequate vitamins will help the body maintain its resistance to colds, flu, etc.

♦ 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.

♦ Almost any component or supplement from military rations makes a good cold weather snack. Avoid high-protein and salty snacks since they can contribute to dehydration.
♦ Eat a high-carbohydrate diet on a regular basis to help maintain the body's energy supply. Carbohydrate loading (the practice of eating a very high-carbohydrate diet while reducing physical activity levels in order to cause the body to store extra glycogen, i.e., carbohydrate) isn't of any special advantage for work other than continuous endurance activity lasting longer than 90 minutes.

♦ Pemmican (an energy-dense, relatively high-fat product favored by arctic explorers)

consumption is not practical for military operations since it requires a period of adaptation to reset the body's metabolic machinery so it can burn such a high-fat diet.

♦ The military has a 4500 calorie dehydrated packaged field ration (the Ration. Cold Weather) available for missions requiring rations with minimum weight and bulk.

♦ If a dehydrated item is eaten dry, the amount of water normally needed to rehydrate that item must be drink 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.	**DON'T** eat snow or ice for moisture.
DO heat food and beverages at every opportunity, prior to eating.	**DON'T** adopt bizarre dietary habits (such as eating only meat and butter) just because of being in the cold.
DO drink more than thirst dictates.	**DON'T** take multivitamin tablets or consume alcohol to "ward off cold" stress.
DO eat snacks between meals.	**DON'T** eat food cold because of being too busy to eat it when it's hot or too busy to stop and heat MREs.
DO moderate coffee and caffeine consumption.	**DON'T** use field training exercises in cold weather as an opportunity to lose weight.

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

Weight Loss

1. Eating enough food is the most important nutritional

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

KEY ISSUES

- **Gastrointestinal Complaints**

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 is incapacitating. The loss of insulating fat decreases 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 increase 15 to 50% 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 3 to 4 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 AMS subside, appetite remains depressed and it takes less food to reach a feeling of fullness - the higher the altitude, the greater the appetite depression.

4. Altitude reduces sense of taste and alters food preferences. These taste changes 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 may 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. Altitude compounds this problem because **cooking times double for each 5000-foot gain in elevation** (since altitude lowers the boiling point of water). 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 from 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; these conditions can be extremely dangerous 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 ensure 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 4 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 of AMS 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 4 cups of snow to make 1 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 longer than the 10 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 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, the amount provided by four Meals, Ready-to-Eat. One Ration, Cold Weather (RCW) or three Food Packets, Long Range Patrol (LRP) 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 T 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 is the biggest problem to develop over time. Any food becomes tiring with repeated consumption. Almost anything different helps 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 are repulsive at altitude if they are 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 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 the soldier is to maintain a high-work capacity. 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" can help to ensure adequate calories and carbohydrate intake if solid foods become unpalatable. Intolerance to solid foods is most likely to happen during the first 2 to 3 days at altitude when the symptoms of AMS are most severe or at extremely high altitudes.

Prevent Dehydration

1. Establish a program of regularly scheduled, enforced drinking. Remind soldiers to drink even when they are not thirsty. Encourage soldiers to drink one canteen of water every 3 hours so that they consume a minimum intake of **5 quarts of water** 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 turn\s pale yellow in color.

POINTS TO REMEMBER

♦ Energy requirements are greater at altitude, therefore there is an increased requirement for the vitamins needed for energy metabolism. Military rations however, already provide more than enough vitamins and minerals so supplementation isn't necessary.

♦ Red blood cell count increases at altitude so the blood can carry more oxygen; however, unless there is a preexisting iron deficiency, there are sufficient body iron stores to meet this sudden but short-term need.

♦ 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.

♦ Adequate protein is needed to protect against muscle loss, but protein requirements are not increased at altitude.

♦ The best snacks for high altitude environments are high-carbohydrate, easy-to-prepare, easy-to-digest, taste good, and are worth their weight and space to carry. Suggested snacks are raisins and other dried fruits, yogurt-covered raisins, banana chips, fruit chews, jelly beans, Chuckles, Gummier Bears, Necco wafers, red and black licorice, granola bars, bagels, toaster pastries, and fig bars.

♦ It's important to military operations at altitude to replenish glycogen stores on a daily basis. **Four to 6 hundred grams of carbohydrates daily** are adequate to continuously replace muscle glycogen stores.

♦ Soldiers generally need at least **4 to 6 quarts** of fluid per day when at altitude because of the extremely dry air. At least 1 quart of fluid must be consumed every 3 hours to meet the requirement.

♦ The edema often seen at high altitudes is not caused by sodium retention, so limiting salt/sodium intake is of no benefit.

♦ For soldiers suffering from AMS, 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 2 hours. Encourage drinking as much fluid as can be tolerated.

♦ 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 addition, the body requires more oxygen to metabolize alcohol.

DOs AND DON'Ts for HIGH ALTITUDE NUTRITION	
DO monitor weight loss if possible.	**DON'T** use mountain exercises as an opportunity to lose weight.

DO eat a high, complex-carbohydrate diet & eat portions of all ration components.	**DON'T** skip meals.
DO serve at least one hot meal per day.	**DON'T** fill up on high-fat foods.
DO provide food variety and plan snacks.	**DON'T** force food when nauseous or vomiting.
DO drink 4 to 6 quarts of noncaffeinated beverages per day & monitor color/volume of urine for dehydration.	**DON'T** drink unpurified water or melted snow.
DO discourage high-fat, pogey bait snack items and alcohol consumption.	**DON'T** restrict water intake in order to "save it for later" or avoid having to urinate.

APPENDIX A

Table A-1. Basic Nutrient[1] Information on Rations

Nutrient	Unit	Standard[2]	A[3] Ration	B[3] Ration	T[3] Ration	MRE[4] XII	GTW[4]
Energy	kcal	3600	3371	4290	3600	4044	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

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

Nutrient	Unit	Standard[2]	Restricted Rations[5]		
			RLW	LRP	GP

Energy	g/%	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

Table A-3. Nutrient Fortification in Rations

Ration Component	Vitamins						Minerals
	A	C	B_1	B_2	Niacin	B_6	Calcium
Beverage Base Powder[6]		X					
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

FOOTNOTES, APPENDIX A

[1]Nutrients provided per day; one ration.

[2]Nutrition standards for rations are what a ration must contain. There are no “requirements” for carbohydrate and fat. The value given for fat if 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 nutrition recommendations for dietary intakes for service members.

[3]Group rations.

[4]Individual rations. Three meals per day, i.e., 3 MREs or 3 Go to War rations (GTW) per day.

[5]Restricted rations: RLW=Ration, Lightweight; LRP=Food Packet, Long Range Patrol; GP=Food Packet, Survival, General Purpose. Restricted rations do not provide enough nutrients to meet the MRDAs.

[6]Note: Sugar-free beverage base powder is not fortified with Vitamin C.

*Data not available.

APPENDIX B

Nutrient Functions And Sources

NUTRIENT	FUNCTION	SOURCE	
		MRE	T Rations
Protein	Build and maintain tissue; regulate water balance; formation of hormones, enzymes, and antibodies; excess intake used as energy	Entrees, cheese, peanut butter	Meats, entrees, milk, cheese, peanut butter
Carbohydrate	Primary energy source; dietary fiber (non-digestible carbohydrate) assists the digestion system	Desserts, fruits, cocoa, candy, beverage base (sugar sweetened)	Pudding, cakes, rice, potatoes, lasagna, bread
Fat	Provide energy; supply fatty acids for cell membranes; absorption of fat soluble vitamins	Peanut butter, entrees, cheese	Breakfast entrees

NUTRIENT	FUNCTION	SOURCE	
		MRE	**T Rations**
Water	Transport of vital substances through body; eliminate wastes from body; regulation of normal body temperature	Beverages, entrees, wet-pack fruits	Beverages, entrees, fruits
Calcium	Build and maintain teeth & bones; normal blood clotting; muscle contraction; healthy cell membranes	Crackers, cheese, cocoa	Lasagna, milk, cheese, macaroni & cheese
Phosphorus	Build bones & teeth; release energy from carbohydrates, fats, and protein; form genetic materials, cell membranes, and many enzymes	Potatoes au gratin, ham entrees	Lasagna, pot roast, potatoes au gratin, chicken

NUTRIENT	FUNCTION	SOURCE	
		MRE	T Rations
Magnesium	Build bone & protein; release energy from muscle glycogen; regulate body temperature	Peanut butter, entrees, cakes, cocoa, coffee	Meats/entrees, bread, cocoa
Iron	Help blood supply oxygen to cells; part of some proteins & enzymes	Entrees	Entrees
Zinc	Essential role in formation of protein (wound healing, tissue growth); component of numerous enzymes	Entrees, cakes	Beef entrees
Sodium	Regulate body fluid volume and blood acidity; transmission of nerve impulses	Salt, entrees	Salt, spaghetti, omelets, rice

NUTRIENT	FUNCTION	SOURCE	
		MRE	T Rations

Potassium	Muscle contraction; maintain fluid & electrolyte balance; transmission of nerve impulses; release of energy from carbohydrate, fat, & protein	Entrees, cocoa, peanut butter, fruits (FD)	Beef & pork entrees
Vitamin C	Formation of collagen (structure of bones, cartilage, muscle); maintain small blood vessels, bones, & teeth; aid iron absorption	Fruits, cocoa, peanut butter, cheese, beverage base, (sugar-sweetened)	Beverage base, cocoa, cheese, peanut butter

NUTRIENT	**FUNCTION**	**SOURCE**	
		MRE	**T Rations**

Vitamin B_1 (Thiamin)	Release energy from carbohydrate; normal function of nervous system	Cocoa, crackers, cheese, peanut butter	Cheese, cocoa, peanut butter, hamburger rolls
Vitamin B_2 (Riboflavin)	Release energy from carbohydrate, protein, & fat	Crackers, entrees	Lasagna, pot roast, ham/eggs, pork w/BBQ sauce
Niacin	Work with thiamin & riboflavin for energy production	Entrees, crackers	Entrees, bread
Vitamin B_6 (Pyridoxine)	Formation of certain proteins; aid in use of fats	Cheese, cocoa, entrees, crackers	Cheese, beef hash, cocoa, chicken breast & gravy

NUTRIENT	**FUNCTION**	**SOURCE**	
		MRE	**T Rations**

Folacin	Formation of hemoglobin in red blood cells; formation of genetic material	Nut cakes, entrees	Lasagna, chicken cacciatore, pork w/BBQ sauce, western omelet
Vitamin A	Healthy skin, hair, mucous membranes, teeth, & bones; aid night vision	Cheese, entrees, cocoa, peanut butter, brownie, cookies	Carrots, peas/carrots, cocoa, cheese
Vitamin C	Protect vitamin A and fatty acids from oxidation; prevent cell membrane damage	Meat balls w/ rice, nut cakes	Omelets, pound cake, lasagna, bread pudding w/ ham

NUTRIENT	**FUNCTION**	**SOURCE**	
		MRE	**T Rations**
Vitamin B_{12}	Red blood cell formation; normal function of nervous system; assist in building genetic material	Entrees	Pork w/BBQ sauce, pot roast, chili, BBQ beef

APPENDIX C

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, glucose-electrolyte type sport 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 or black stools 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	Numb, shriveled skin
Increased pulse rate	Inability to walk	Painful urination
		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 2 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), light-headedness, 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 beverage base or lemon tea, not artificially sweetened), granola bars, hard candies, and trail mix.