

Chapter 22

NUTRITION AND WEIGHT CONTROL

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INTRODUCTION

Weight issues plague all branches of the US military. Many recruits begin service at a higher weight or body-fat percentage than permitted once initial entry training is completed. Weight problems add stress to already stressful jobs, costing many soldiers promotions and causing some soldiers to try desperate measures (eg, fad dieting, rubber suits, diet pills) to shed pounds.

Each military service has effective weight-control programs that combine diet and exercise under the supervision of registered dietitians. However, according

to federal statistics, 43% of females and 18% of males of recruiting age exceed screening weights for military service. Therefore, recruits need to be educated properly about the dangers of excess weight and body fat and healthy ways to control them.

The military has made a commitment to supply information on nutrition education, physical activity / exercise, weight-loss methods, stress management, and behavior modification techniques to safely lower and maintain body weight and body-fat percentages.

WEIGHT GAIN AND WEIGHT STANDARDS

The unprecedented rate of weight gain in the general US population has received much attention; likewise, weight gain has become a serious health problem for active duty members of the US military. In 2001, then Surgeon General David Satcher warned, "Overweight and obesity may soon cause as much preventable disease and death as cigarette smoking."¹ The incidence of overweight and obesity varies widely within different segments of the population in the United States; a greater likelihood of overweight and obesity is found in minority populations and individuals with lower household incomes.² According to the 1999–2000 National Health and Nutrition Examination Survey (NHANES), 64% of US adults are considered overweight or obese.³ Between 1979 and 1999, the prevalence of obesity doubled from to roughly 31% of adults aged 20 to 74 years.³ Although tobacco use remained the leading cause of mortality in 2000 (435,000 deaths; 18.1% of US deaths), poor diet and physical inactivity were only a fraction behind (400,000 deaths; 16.1% of US deaths).⁴ The situation has also become more problematic within the adolescent population. Estimates from the most recent data (1999–2000) from NHANES are that 15% of children aged 6 to 19 years are overweight. This represents more than a 2-fold increase since NHANES II (1976–1980), when 7% of children aged 6–11 and 5% of children aged 12–19 were overweight.⁵

Just as average weight has increased in the civilian population, changes have also been noted in the active duty military population. Since the early 1990s, the rate of overweight individuals in the military has become more consistent with that of the civilian population.⁶ Factors correlating with rates of overweight individuals within the military are educational level and racial background. The average military recruit enters military service upon graduation from high school. Individuals with education levels beyond high school are less likely to be obese⁷ and more likely to be knowl-

edgeable about nutrition.⁸ A 2003 study of body mass index (BMI) based on self-reported weights within an African American population—representing a wide range of educational and economic backgrounds—resulted in a mean BMI greater than 25, thus classifying the overall study population as overweight.⁹

Although the issue of the underweight military recruit does occur, the civilian population from which the military is comprised is more likely to exceed the allowable military weight ranges.¹⁰ A study of 17- to 20-year-olds participating in NHANES III found that a high percentage of the individuals, especially minorities, would be considered overweight according to military regulations.¹⁰

The military services have different weight and body composition standards. For example, the US Army's weight standards are dependent on the service member's length of time in the military. Army Regulation 40-501, *Standards of Medical Fitness*, governs accession body composition standards for the first 6 months of active duty service for the initial entry training recruit.¹¹ If the recruit exceeds the allowable weight standard chart, his or her body fat is assessed by a taping method described in Army Regulation 600-9, *The Army Weight Control Program*.¹² If the service member also exceeds the allowable body-fat standards, he or she will be rejected for service.¹¹ The US Air Force, however, uses a system that combines weight and body fat measurements with physical performance scores.

A comparison of three of the four services (Army, Navy, and Marines) reveals that the Army weight standards are more stringent when compared with the other branches (Table 22-1). However, weight is not the only determinant of whether an individual is placed on a weight control program; assessment of body fat is also considered. Department of Defense (DoD) Directive 1308.3, *DoD Physical Fitness and Body Fat Program*,¹³ mandates a more centralized approach to the services and body-fat determination (see Attachment 1). Individuals

TABLE 22-1
SELECTED MAXIMUM WEIGHT FOR HEIGHT
BY US MILITARY SERVICE

Service Branch	Men (max wt [lb] for selected ht [in.])		Women	
	60 in.	80 in.	60 in.	80 in.
Army (dependent on age)	132–141	234–250	116–127	208–227
Navy	141	241	141	227
Marines	141	250	128	228
Air Force	NA	NA	NA	NA

max wt: maximum weight

ht: height

NA: not applicable; the Air Force uses abdominal circumference (body composition) along with aerobic and muscle fitness to determine a fitness score

Data sources: (1) US Department of the Army. *The Army Weight Control Program*. Washington, DC: Headquarters, DA; 10 June 1987. Army Regulation 600-9. (2) US Department of the Navy. *Physical Readiness Program*. Washington, DC: Headquarters, DN; 10 October 2002. OPNAV Instruction 6110.1G. (3) US Department of the Navy, Headquarters, US Marine Corps. *Marine Corps Physical Fitness Test and Body Composition Program Manual*. Washington, DC: Headquarters, DN, USMC; 10 May 2002. Marine Corps Order P6100.12. (4) US Department of the Air Force. *Fitness Program*. Washington, DC: Headquarters, DAF; 1 January 2004. AF Instruction 10-248.

whose weight exceeds the weight-for-height tables for their branch of service must be taped circumferentially to determine body fat. For women, the method includes adding the measurement (in inches) of the hip and waist circumferences (waist circumference is measured at the thinnest portion of the abdomen) and subtracting the neck measurement (in inches). In the Army, however, women are measured at the hips, forearm, neck, and wrist (this policy is undergoing consideration for revision). The method is different for men, using only two

measurements: the neck and abdomen (circumference is measured at the navel). The neck measurement is subtracted from the abdominal measurement to determine body-fat percentage. Example formulae for both men and women follow (all circumference and height measurements are in inches)¹³:

Men

$$\% \text{ body fat} = 86.010 \times \log_{10} (\text{abdomen} - \text{neck}) - 70.041 \times \log_{10} (\text{height}) + 36.76$$

Women

$$\% \text{ body fat} = 163.205 \times \log_{10} (\text{waist} + \text{hip} - \text{neck}) - 97.684 \times \log_{10} (\text{height}) - 78.387.$$

Service members who exceed the body-fat standards are subject to enrollment in a weight-control program¹³; the weight-control programs are different for each service. The Army's maximum allowable body-fat standards for men and women for the first 6 months of active duty are listed in Table 22-2.¹¹

Army Regulation 600-9 governs body composition standards following the first 6-month period of service.¹⁴ The regulation lists the maximum allowable body-fat percentages by gender and age, but goes on to state, "all personnel are encouraged to achieve the more stringent Department of Defense (DoD)-wide goal, which is 20% body fat for males and 26% body fat for females."¹²

Soldiers failing to meet the body composition standards listed after 6 months of active duty service are enrolled in the Army Weight Control Program¹⁴ Allowable body-fat percentages following the first 6 months of Army service are shown in Table 22-3.

A comparison of the allowable weight-control standards reveals distinct differences among the military services (Table 22-4). The Army categorizes soldiers by gender into four different age groups, with increasing

TABLE 22-2
US ARMY ALLOWABLE BODY-FAT PERCENTAGES (BY AGE) FOR THE FIRST 6 MONTHS OF
ACTIVE DUTY

	Men	Women	Men	Women	Men	Women	Men	Women
Age (yr)	17–20	17–20	21–27	21–27	28–39	28–39	≥ 40	≥ 40
Body fat (%)	24	30	26	32	28	34	30	36

Data source: US Department of the Army. *Standards of Medical Fitness*. Washington, DC: Headquarters, DA; 2003. Army Regulation 40-501.

TABLE 22-3
US ARMY ALLOWABLE BODY-FAT PERCENTAGES (BY AGE) AFTER THE FIRST 6 MONTHS OF ACTIVE DUTY

	Men	Women	Men	Women	Men	Women	Men	Women
Age (yr)	17–20	17–20	21–27	21–27	28–39	28–39	≥ 40	≥ 40
Body fat (%)	20	28	22	30	24	32	26	34

Data source: US Department of the Army. *The Army Weight Control Program*. Washington, DC: Headquarters, DA; 10 June 1987. Army Regulation 600-9.

weight and body-fat allowances by age.¹² The Navy and Marine Corps do not allow increasing weight with age; however, the Navy makes allowances for body fat as the service member ages. The Navy separates its military population by gender and ages of less than 40 years, and 40 years and older.¹⁵ Maximal allowed body fat for men and women under 40 years

of age is 22% and 33%, respectively. Members over 40 are allowed body-fat increases to 23% (men) and 34% (women).¹⁵ The Marine Corps has no body-fat changes across the age continuum. Men are subject to body-fat standards of 18%, whereas women are allowed a body fat of 26%.¹⁵

Military Trends

It is a common misconception that excess body weight or body fat is not a significant problem in the military.¹⁶ However, studies using BMI measurements show that many service members are overweight. The Centers for Disease Control and Prevention defines overweight as a BMI of 25 to 29 kg/m² and obesity as a BMI of greater than 30.0 kg/m².^{17,18} Applying these guidelines to the active duty military population, the Institute of Medicine (IOM) reported a comparison of overweight and obesity rates for the US armed services (Table 22-5). As can be derived from Table 22-5, 60% of Army men, 69% of Navy men, and 64% of Air Force men are either overweight or obese. For women, 41% of those in the Army, 46% of those in the Navy, and 35% of those in the Air Force are either overweight or obese.

Another common misconception about the military is that elevated body weight is probably more indicative of muscularity than of fat. However, based on their research, Robbins and colleagues “suggest that increased weight for height is no less related to adiposity in military populations than among civilians.”^{16(p395)} Seidell and Flegal¹⁹ agree that there are always extremes and individual cases in which use of BMI would be inappropriate. Also, however, they say that “despite these obvious extremes, there is a very good correlation between BMI and the percentage of body fat in large populations.”^{19(pp238–239)}

The fact that the rate of adolescent obesity has tripled since 1980 affects the military in two obvious ways: (1) the pool of individuals eligible for recruitment is smaller—among young men and women aged

TABLE 22-4
PERCENTAGE OF BODY-FAT ALLOWANCES (BY AGE AND GENDER) IN US MILITARY SERVICES

		Age (yr)			
		17–20	21–27	28–39	≥40
Branch	Gender	Body Fat (%)			
Army	Men	20	22	24	26
Navy	Men	22	22	22	23
Marines	Men	18	18	18	18
Air Force	Men	NA	NA	NA	NA
Army	Women	28	30	32	34
Navy	Women	33	33	33	34
Marines	Women	26	26	26	26
Air Force	Women	NA	NA	NA	NA

NA: not applicable; the Air Force uses a combination of abdominal circumference plus aerobic and muscular capabilities.
Data sources: (1) US Department of the Army. *The Army Weight Control Program*. Washington, DC: Headquarters, DA; 10 June 1987. Army Regulation 600-9. (2) US Department of the Navy. *Physical Readiness Program*. Washington, DC: Headquarters, DN; 10 October 2002. OPNAV Instruction 6110.1G. (3) US Department of the Navy, Headquarters, United States Marine Corps. *Marine Corps Physical Fitness Test and Body Composition Program Manual*. Washington, DC: Headquarters, DN, USMC; 10 May 2002. Marine Corps Order P6100.12. (4) US Department of the Air Force. *Fitness Program*. Washington, DC: Headquarters, DAF; 1 January 2004. AF Instruction 10-248.

TABLE 22-5

COMPARISON OF BODY MASS INDEXES IN THREE US MILITARY SERVICES* AND THE GENERAL POPULATION

BMI	BMI for Army		BMI for Navy		BMI for Air Force		BMI for US Population [†]	
	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)
< 18.5	0.3	0.6	0.5	1.8	0.9	3.0	—	—
18.5–24.9	39.6	58.8	30.4	52.2	6.7	62.2	32.8	38.1
25.0–29.9	46.0	34.4	52.9	38.6	52.7	31.4	39.8	28.5
30.0–34.9	13.2	5.6	14.3	6.5	10.5	2.8	26.0	30.6
35.0–39.9	0.9	0.5	1.7	0.8	0.7	0.4	—	—
≥ 40	< 0.1	< 0.1	0.2	0.1	< 0.1	< 0.1	1.5	2.8

*No data available for the US Marine Corps.

[†]BMI categories for US population: < 25, 25.0–29.9, 30.0–39.9, ≥ 40.

BMI: body mass index

—: no data available

Adapted from: Institute of Medicine. Background and context of the overweight problem. In: Subcommittee on Military Weight Management, Committee on Military Nutrition Research. *Weight Management: State of the Science and Opportunities for Military Programs*. Washington DC: National Academies Press; 2003: 17–28. Available at: <http://books.nap.edu/books/0309089964/html/index.html>. Accessed August 27, 2003

17 to 20, an estimated 13% to 18% of men and 17% to 43% of women fail to meet the DoD weight-for-height and body-fat accession standards;²⁰ and (2) excess weight reduces retention in the military. As the IOM reports, “almost 80% of recruits who exceed the accession weight-for-height standards at service entry leave the military early (ie, by year 2 of a 3–4 year enlistment).”^{21(pp17–18)}

Excess Weight Carries Excess Cost

The costs of obesity and overweight are high. Estimated annual costs of excess weight in the United States vary, with the latest estimate at \$117 billion (\$61 billion direct costs and \$56 billion indirect costs).²² Investigators estimate that excess body weight costs the Air Force approximately \$23.9 million per year in healthcare dollars, representative of 7% of all annual medical care expenditures.¹⁶ Furthermore, excess body weight contributed to approximately 33,635 lost work-days per year or about a \$4.2 million per year loss in productivity.¹⁶

Cost, health, productivity, and appearance are important issues to both the US civilian population and the military. However, the greatest operational impact of overweight and obesity among active duty military members relates to readiness. A member’s physical fitness level strongly indicates his or her ability to perform necessary tasks during a wartime mission.

Excess Weight Adversely Affects Readiness

Consequences of excess weight include a negative effect on fitness scores. For example, in the Air Force before 2004, each individual’s physical fitness was assessed annually using submaximal cycle ergometry to estimate maximal oxygen uptake.¹⁸ In a retrospective cohort study of more than 38,000 active duty Air Force members aimed at identifying demographic and behavioral factors that increase the risk of failing Air Force fitness standards, interesting and significant results emerged¹⁸: “Among men, overweight and obesity as measured by BMI was [sic] the behavioral factor with the largest effect on risk of low fitness, with aerobic exercise frequency ranked second; among women, the order of these two factors was reversed.”^{18(p94)} Regardless of gender, excess body weight and aerobic exercise frequency persist as the behavioral factors with the greatest effect on Air Force physical fitness scores.¹⁸

Weight-based disciplinary action is both costly and time-consuming for commanders. Despite multiple programs focusing on behavior, nutrition, and activity for members who exceed weight and body-fat standards, in fiscal year 2001, more than 4,600 individuals were discharged from the military because of their inability to meet weight standards.²⁰ In 2002, the numbers of discharges from overweight had declined, but the majority of the decline was a result of the Navy’s

decision to halt discharges for overweight. Even with this policy change, 1,400 individuals were discharged. A DoD study²³ found that the loss of these 1,400 individuals cost the military services about \$57 million in 1995 dollars, based on the \$40.283 per person cost of recruitment and training.

Historically, each armed forces medical service has had intervention programs for active duty members who exceeded weight and body-fat standards. These interventions, although generally successful in keeping most service members from succumbing to administrative actions, have not reduced the aggregate weight of the force.

Recommendations for an Approach to Prevention of Weight Gain

As with other health issues, an emphasis on prevention is vital for weight control to be both effective and economical.²⁴ Large amounts of literature support the fact that, once an individual becomes overweight, it is very difficult to lose the excess weight. Furthermore, the likelihood of regained weight is high.²¹ The IOM suggests that, “since the majority of military recruits will have met the DoD weight-for-height and body-composition standards at the time of entry into the service, the need for combat optimal health, and economics dictate that the prevention of weight gain should be a major focus of military health programs and research.”^{25(p125–126)}

The US military services have a unique opportunity for prevention, because most active duty members spend much of their time in environments directly controlled by the military, and the military controls the physical standards and activities for its recruits.²⁵ (The caloric content of the food in the mess hall diet and in operational settings is discussed later in this chapter.) Another advantage is that the military has the ability to mold the belief systems and behaviors of its young recruits. The IOM states that, “[i]f the military made a commitment to nutrition education and physical activity as part of the ‘military lifestyle,’ generations of young people would have a high possibility of adopting good nutrition and exercise habits as a part of expected behavior.”^{21(p126)} Workplace interventions in the services provide opportunities for enhancing communication, because communication channels

have already been created and can reach large numbers of people at relatively low cost. The social structure and physical environment may also be used to influence change in eating habits and physical activity.²⁶ Environmental changes in the workplace, such as healthy eating and exercise education and incentives, can greatly assist individuals in both losing and maintaining weight.²⁶

The IOM had several recommendations for weight-gain prevention within the military services:

- Develop a weight-gain risk factor identification system including such indices as overweight at the time of accession, family history of obesity, and a gain of more than 5% over initial entry training weight.²¹ Education of individuals identified to be at risk might promote self-directed preventive measures.²¹
- Incorporate training on diet and exercise into initial entry training, which goes hand in hand with learning other military tasks. Spouses and other family members may also benefit from such instruction.²¹
- Integrate physical fitness as a way of life. This should be instilled from the beginning and become part of the culture in the form of programs, upgraded facilities and equipment, incentives, and education.²¹
- Ensure that healthy food options are standard for base facilities. Military cooks should be trained in healthy cooking techniques.
- Review base contracts for eating establishments to include priorities for those that offer healthier choices and reasonable portion sizes.²¹

Clearly, prevention is the most proactive and cost-effective approach in reducing the incidence of overweight and obesity, with the goal of avoiding these conditions rather than attempting weight loss in the future.²⁴ Furthermore, establishing a positive health culture for military trainees provides the foundation for preventing future problems with weight and sedentary lifestyles: “Prevention and environmental change are more fruitful targets for intervention, with public health approaches being best suited to address prevention.”^{27(p205)}

COUNTERING OVERWEIGHT AND OBESITY: A HEALTHY DIET

What is a healthy diet? Countless books have been published and studies performed as researchers explore the relationship between diet and health. In recent years, the top two causes of death, heart disease

and cancer, have been associated with poor dietary habits (as have numerous other health problems, such as diabetes, osteoporosis, high blood pressure, and stroke). People do not choose foods based on

disease prevention or nutrition knowledge, but rather on other factors such as taste, environment, culture, and socioeconomic status. A healthy diet provides adequate protein, fat, carbohydrates, vitamins, and minerals without providing excess calories that lead to overweight and obesity. These nutrient needs are different for each person and are determined by the person's gender, age, size, and overall health. All foods fit into a healthy diet as long as three basic principles are followed: variety, moderation, and safety.

Variety

When it comes to food, variety is not only enjoyable but also essential. No single food contains all the necessary nutrients; therefore, it is important to choose daily foods from each of the five food groups in the US Department of Agriculture's Food Guide Pyramid: (1) dairy, (2) meat and meat alternatives, (3) fruits, (4) vegetables, and (5) grains.

Two to three servings of dairy products (milk, yogurt, cheese, etc) provide calcium and vitamin D to support bone growth. Meats and alternatives (eg, eggs, nuts, beans, and legumes) provide protein, B vitamins, iron, and zinc; approximately 5 to 7 oz daily provide adequate amounts of these nutrients for most people. Fruits and vegetables provide vitamins A and C, as well as fiber, magnesium, potassium, and some iron. Many Americans eat less than the recommended 3 to 5 servings of vegetables and 2 to 4 servings of fruit per day. Six to 11 daily servings of breads, cereals, rice, and pasta provide adequate complex carbohydrates, fiber, vitamins, and minerals. Low-fat, whole-grain products provide needed fiber without excess calories.

Moderation

Moderation ensures that appropriate amounts of food are taken in. Monitoring portion sizes is important to ensure adequate nutrition without consumption of too much fat and calories. Although plant-based foods should provide the majority of calories, people choosing to exclude animal products altogether can still have a healthy diet. Those individuals who avoid dairy products can include other good sources of cal-

cium; and vegetarians (who avoid all meat) must find alternative sources of protein, zinc, and iron. Many Americans eat more sugar and salt than are needed for good health. Excess sugar can cause tooth decay and contribute to obesity. Therefore, it is wise to limit foods with added sugar.

Eating less than 2,400 mg sodium (a little more than one teaspoon of salt) per day can reduce the risk of high blood pressure in some people. Sodium is found in many condiments and other processed foods. Alcohol is high in calories and provides little nutrition. One drink per day for women and two drinks per day for men may fit into a healthy diet, but children, pregnant women, and people on certain medications should avoid alcohol altogether.

Safety

Safe food is free from harmful bacteria, viruses, parasites, and chemical contaminants that could cause food-borne illness. Preventing food-borne illness can be done through sanitation and proper food storage and preparation. Food handlers should wash their hands regularly, as well as the counters and equipment that contact food. Perishable food must be stored at the proper temperature—refrigerate food at less than 40°F and keep frozen food below 0°F. Food should be thawed in the refrigerator, microwave, or under cold running water rather than at room temperature. Uncooked or partially cooked animal products may contain bacteria or viruses. Cooking meat to 160°F to 180°F (depending on the product) greatly reduces the risk of food-borne illness.

Military dining facilities usually place great emphasis on sanitation and safe food handling. A single failure in such a facility, however, has the potential to affect a great many recruits at once. A more common problem is contaminated food that is prepared by recruits in the barracks or other places that lack regular cooking facilities. Likewise, contamination in the field environment usually occurs after group rations are delivered from the mess facility (eg, by a failure of the detailed servers to wash their hands before ladling out the food) or when individual rations such as Meals, Ready to Eat (MREs) are prepared and eaten in unsanitary conditions.

NUTRITION AND ENERGY BALANCE

Food nourishes and provides energy to the body. These two basic functions require variety and balance when selecting foods. This section discusses the body's energy and nutrient needs for the promotion of optimal nutrition and energy balance.

Energy Balance

Energy balance refers to the input and output of calories in the body. Energy is measured in kilocalories (kcal), which are commonly called calories. Calories are

TABLE 22-6
APPROXIMATE DAILY ENERGY EXPENDITURE

Daily Use	Approximate % of Total Energy Consumed
Basal metabolism	60
Physical activity	30
Digestion of food and absorption of nutrients	10
Total Energy	100

Data source: American Dietetic Association. *Complete Food & Nutrition Guide*. 2nd ed. Hoboken, NJ: John Wiley & Sons, Inc; 2002: 26.

used to describe the amount of energy derived from food and the amount of energy burned by the body. Food provides calories in the form of carbohydrates, protein, and fats, which are converted to glucose or

blood sugar. The body either uses or stores the energy from food. Excess energy is stored as fat or glycogen.

Energy Requirements

The body needs energy to fuel basal metabolism (involuntary activities that sustain life) and voluntary activities (Table 22-6). The basal metabolic rate is influenced by several factors, including age, height, growth, body composition, fever, stress, environmental temperature, fasting or starvation, malnutrition, and amount of thyroxine present (the thyroid hormone that controls metabolism). Physical activity increases energy needs and may increase basal metabolic rate if performed consistently.

Individual energy requirements for healthy adults have been determined by the National Academy of Sciences' Food and Nutrition Board using the estimated energy requirement (EER). EER determines the dietary energy intake required for individuals of a defined gender, age, height, weight, and level of activity.

TABLE 22-7
ESTIMATED ENERGY REQUIREMENTS FOR MEN AND WOMEN 30 YEARS OF AGE

Height (m)	Physical Activity Level	Men, EERs (kcal/d)		Women, EERs (kcal/d)		Physical Activity Factor		Physical Activity Description ^a
		BMI=	BMI=	BMI=	BMI=	Men	Women	
		18.5 kg/m ²	24.99 kg/m ²	18.5 kg/m ²	24.99 kg/m ²			
1.50 [†]	Sedentary	1,848	2,080	1,625	1,762	1.0	1.0	‡
	Low active	2,099	2,267	1,803	1,956	1.11	1.12	1.5–3 mi/d
	Active	2,215	2,506	2,025	2,198	1.25	1.27	3–10 mi/d
	Very active	2,554	2,898	2,291	2,489	1.48	1.45	≥ 10 mi/d
1.65 [§]	Sedentary	2,068	2,349	1,816	1,982	1.0	1.0	‡
	Low active	2,254	2,566	2,016	2,202	1.11	1.12	1.5–3 mi/d
	Active	2,490	2,842	2,267	2,477	1.25	1.27	3–10 mi/d
	Very active	2,880	3,296	2,567	2,807	1.48	1.45	≥ 10 mi/d
1.80 [¶]	Sedentary	2,301	2,635	2,015	2,211	1.0	1.0	‡
	Low active	2,513	2,884	2,239	2,459	1.11	1.12	1.5–3 mi/d
	Active	2,782	3,200	2,519	2,769	1.25	1.27	3–10 mi/d
	Very active	3,225	3,720	2,855	3,141	1.48	1.45	≥ 10 mi/d

*For a person of average weight, physical activities are equivalent to walking at 2–4 mph.

[†]Weight for BMI of 18.5 kg/m²: 41.6 kg (92 lb); weight for BMI of 24.99 kg/m²: 56.2 kg (124 lb).

[‡]Only physical activities required for independent living.

[§]Weight for BMI of 18.5 kg/m²: 50.4 kg (111 lb); weight for BMI of 24.99 kg/m²: 68.0 kg (150 lb).

[¶]Weight for BMI of 18.5 kg/m²: 59.5 kg (132 lb); weight for BMI of 24.99 kg/m²: 81.0 kg (178 lb).

BMI: body mass index

EER: estimated energy requirement

Data source: Food and Nutrition Board, Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients)*. Washington, DC: FNB/IOM; 2002: 149–150. Available at: www.nap.edu. Accessed July 15, 2004.

Enough energy is needed to sustain a healthy and active life, but too much energy can lead to obesity.

Table 22-7 lists EERs for men and women 30 years of age and the amount of energy used for voluntary activities (which depends on the type of activity), the individual's weight, and the time spent performing the activity. EERs can be calculated using gender-specific equations for individuals 19 years of age and older. For each year of age below 30, add to the calculated EER 7 kcal/d for women and 10 kcal/d for men; for each year of age above 30, subtract from the calculated EER 7 kcal/d for women and 10 kcal/d for men:

Men

$$\text{EER} = 662 - 9.53 \cdot \text{age} + \text{PA} \cdot (15.91 \cdot \text{wt} + 539.6 \cdot \text{ht})$$

Women

$$\text{EER} = 354 - 6.91 \cdot \text{age} + \text{PA} \cdot (9.36 \cdot \text{wt} + 726 \cdot \text{ht}),$$

where age represents the individual's age (in years), PA represents the physical activity factor (see Table 22-7), wt represents the individual's weight (in kilograms), and ht represents the individual's height (in meters). Depending on the type of training they are receiving, recruits will likely fall into either the active or very active categories of physical activity level. Some physical activities and the calories burned while performing them are shown in Table 22-8.

To maintain weight, the amount of energy consumed must equal the amount of energy exerted. The input/output energy balance relationship determines whether a person loses or gains weight. An individual can gain weight by increasing caloric intake and reducing physical activity, or lose weight by decreasing caloric intake and increasing physical activity. It takes about 3,500 kcal to equal 1 lb of body fat. Therefore, a 3,500-kcal deficit over time will result in a loss of 1 lb of body weight. The reverse is true for weight gain.

TABLE 22-8

CALORIES BURNED (PER HOUR) BY ACTIVITY AND BODY WEIGHT

Activity	120 lb	170 lb
Aerobic dance	330	460
Basketball	330	460
Bicycling (< 10 mph)	220	310
Bowling	165	230
Calisthenics	250	345
Driving a car	110	155
Eating	80	115
Food preparation	135	385
Golf (walking)	250	345
Hiking	330	460
Jogging	385	540
Mowing lawn	300	425
Racquetball	385	540
Reading	70	100
Rowing, stationary	385	540
Running (10 mph)	880	1,230
Sitting (watching TV)	55	75
Sitting (writing, typing)	100	140
Skating, roller	385	540
Sleeping	50	70
Soccer	385	540
Swimming, leisure	330	460
Walking, brisk	220	310
Weight training	165	230

Data sources: (1) American Dietetic Association. *Complete Food & Nutrition Guide*. 2nd ed. Hoboken, NJ: John Wiley & Sons, Inc; 2002: 28. (2) Ainsworth BE, Haskell WL, Leon AS. Compendium of physical activities: Classification of energy costs of human physical activities. *Med Sci Sports Exerc*. 1993;25:71–80.

NUTRIENTS: THE BASICS

Nutrients can be divided into two groups: (1) macronutrients and (2) micronutrients. Macronutrients are the food components that the body uses for energy. Micronutrients, which do not produce usable energy, are vitamins and minerals whose roles include assisting macronutrients to metabolize food, build bone, assist in hormone production, enhance eye and skin health, protect against cancer, assist blood clotting, promote nervous function, and build red blood cells.

The dietary reference intakes (DRIs) established by the Food and Nutrition Board provide recommendations for daily nutrient intake. The DRIs consist of five

nutrient recommendations for healthy adults:

1. recommended dietary allowances,
2. adequate intakes,
3. tolerable upper intake levels,
4. estimated average requirements, and
5. EERs.

Macronutrients

Food is made up of three macronutrients: (1) carbohydrates, (2) proteins, and (3) fats. Each macronutrient

contributes to the total calories in food. Macronutrients provide the usable energy that the body needs to function. Adults and children (4–18 years of age) should consume 45% to 65% of their caloric intake in the form of carbohydrates. Adults should consume 10% to 35% of their caloric intake in the form of proteins; children, 10% to 30%. Adults should obtain 20% to 35% of their calories from fats; children, 25% to 35%.²⁸

Carbohydrates

Carbohydrates are the body's direct source of energy. The DRI for carbohydrates is 45% to 65% of total daily calories. Each gram of carbohydrate contains about 4 kcal.

Carbohydrates include simple sugars and complex sugars called starches. Simple sugars are the most commonly consumed sugars in the American diet. They include sucrose, found in table sugar; lactose, found in dairy products; and fructose, found in fruits and honey. Complex sugars, or starches, are found in grains and vegetables. The *Dietary Guidelines for Americans*²⁹ recommends a variety of grains daily (especially whole grains) and a variety of fruits and vegetables. In addition to providing energy, these foods also provide fiber, vitamins, minerals, and phytonutrients (other plant substances), which provide health benefits that lower the risk of developing or worsening health problems. The recommended amount and types of carbohydrate to be consumed daily depend on individual activity levels and health status. For example, on one hand, a patient with controlled diabetes (such patients are allowed to remain in the military) should be more restrictive of the total number of carbohydrates and the amount of simple sugars consumed. On the other hand, a recruit who is engaged in physically demanding training may require a higher total number of calories, the majority of which may come from simple carbohydrates.

Proteins

Proteins are used to build, repair, and maintain muscle. The DRI for protein is 10% to 35% of total daily calories for adults. Each gram of protein contains about 4 kcal.

Proteins are made up of amino acids, which are either essential or nonessential. Essential amino acids must come from food sources because the body is not able to synthesize them, as it can synthesize nonessential amino acids. Proteins provide energy when carbohydrates are not available, make enzymes and hormones, and maintain a healthy immune system. Proteins are found in meat, poultry, eggs, fish, dairy products, soy products, beans, and vegetables.

Fats

Fats are a concentrated source of energy that helps to absorb nutrients (eg, vitamins A, D, E, and K). For adults, the DRI for fats is 20% to 35% of total daily calories. Each gram of fat contains about 9 kcal, which is more than double the amount provided by either carbohydrates or proteins.

Micronutrients

When compared with macronutrients, the body needs vitamins and minerals in relatively smaller amounts. Vitamins and minerals play important roles in all processes that occur in the body. Vitamins work as regulators, acting as coenzymes. Minerals also act as coenzymes, while also playing a major part in cell development (ie, bone, tooth, and nail growth; fluid and electrolyte balance; and acid–base balance).

The current position of the American Dietetic Association is the following: the best nutritional strategy for promoting optimal health and reducing the risk of chronic disease is to obtain adequate nutrients from a wide variety of foods. Vitamin and mineral supplementation is appropriate when well-accepted, peer-reviewed scientific evidence shows safety and effectiveness.

Vitamins

The 13 different vitamins are grouped into two categories: (1) water-soluble and (2) fat-soluble. Water-soluble vitamins (the B-complex vitamins and vitamin C) are carried in the bloodstream and are not stored in the body in significant amounts. The body uses what water-soluble vitamins it needs and excretes the extra amount through the urine. A regular supply of water-soluble vitamins is needed from food choices. Although water-soluble vitamin toxicity is rare, large doses of certain water-soluble vitamins may cause kidney stones or diarrhea. Moderation is the best approach when consuming vitamin supplements.

Fat-soluble vitamins (vitamins A, D, E, and K) travel through the bloodstream attached to fat. The body can store fat-soluble vitamins. Vitamins A and D can build to toxic levels, but vitamins E and K are not usually linked with symptoms of toxicity.

Minerals

Minerals are inorganic. Heat or food processing cannot destroy them. Minerals are usually described in two categories: (1) major minerals (calcium, phosphorus, magnesium, sodium, chloride, potassium, and sulfur) and (2) trace minerals (iodine, iron, zinc, and selenium).

DIETARY MYTHS AND MISINFORMATION

Why is the nutrition field ripe for misinterpretation? Perhaps it is because nutritional science is a dynamic field; new discoveries and advances challenge old paradigms, giving way to new ideas and recommendations. Inherent in any dynamic field is myth and misinformation; quackery and fraud undermine the legitimacy of the field and draw into question the professionals who work in it.

Behind nearly all nutritional myths, health quackery, and food faddism is the promotion of foods, supplements, or both, and other products that are expensive and potentially unsafe. Health consequences are of great concern because they may delay medical care, interrupt legitimate treatments or therapies, and create drug and nutrient interactions.²⁹

For most Americans, the mass media are the leading sources of health and nutrition information.³⁰ Health and nutrition information are often taken out of context and fed to the media for the purposes of selling subscriptions, boosting ratings, and making money, all of which can have dramatic consequences on creating, shaping, and perpetuating myths. Military service members, including recruits, are subject to influence and misinformation from the mass media just like other consumers.

Dietary Myths

Health professionals and nutrition students at the University of California, Los Angeles,³¹ and at the National Institute of Diabetes and Digestive and Kidney Diseases have compiled some common nutritional

myths.³² Many healthcare professionals encounter and debunk these myths and others when counseling patients on weight loss (Exhibit 22-1).

Weight-Loss Advertising Claims

Weight-loss advertising has consistently caught the attention of the Federal Trade Commission (FTC). Recently, the FTC—collaborating with the Partnership for Healthy Weight Management and other organizations—released a report on deceptions in weight-loss advertising. This report involved a review of approximately 300 advertisements (published from 1992 through 2001) from television, radio, magazines, newspapers, direct mailings, commercial e-mails, and Internet Web sites. The collaborators determined that 55% of all the advertisements “made at least one false or unsubstantiated claim.”³⁰ Exhibit 22-2 contains some of these claims.

The FTC offers the following advice to consumers interested in weight-loss products or programs: “Products and programs that promise quick and easy weight loss are scams. The faster you lose weight, the more likely you are to gain it back. There are no miracle weight loss products. If it sounds too good to be true, it is, and be very skeptical about exaggerated claims.”³¹ Education on how to spot deceptive advertising and how to improve the health literacy of all Americans remains the primary weapon of choice for consumers to combat health and nutritional myths and misinformation.

WEIGHT-LOSS DIETS AND DIETARY SUPPLEMENTS

Diets

Losing weight through negative energy balance can be safe and effective, as long as sufficient macronutrients and micronutrients are consumed. Many popular diets cause short-term weight loss, but are nutritionally imbalanced and cannot be used for long-term weight maintenance. Military service members and recruits are responsible for maintaining good health and nutrition status even during weight loss. This makes it crucial for military members to be able to distinguish a healthy diet for weight loss from an imbalanced fad diet.

There are hundreds of weight-loss plans, each with its own desired macronutrient balance (Attachment 2). On one hand, many diets are sound and safe food prescriptions that help people lose weight, improve health, incorporate exercise, and

can be followed for a lifetime. On the other hand, many diets have quick weight loss as their main selling point; they do not actually teach the dieter how to eat in a healthy manner. These are known as fad diets; they promise quick, permanent, effortless weight loss without exercising, counting calories, or going hungry (Exhibit 22-3).

Dietary Supplements

The marketplace is filled with dietary supplements claiming to help users lose weight or have more energy (Table 22-9). More than half of the US population uses dietary supplements, often with the assumption that the product is safe and effective.^{33,34} In the Dietary Supplement Health and Education Act of 1994, Congress defined dietary supplements as products taken orally that contain ingredients to supplement

EXHIBIT 22-1**DEBUNKING DIETARY MYTHS**

Myth	Fact
Vitamin supplements provide everything you need to maintain good health.	More is not better when it comes to vitamin and mineral supplements. They do not contain important nutrients like fiber, phytochemicals (disease-fighting chemicals found in fruits and vegetables), and cannot neutralize the effects of an unhealthy diet and lifestyle (eg, tobacco use and sedentary lifestyle).
95% fat-free means that only 5% of the calories come from fat.	95% fat-free means that 5% of the total <i>weight</i> of the product is from fat. Example: Popular sliced deli meats are often labeled as 95% fat-free. However, closer examination of the label reveals that each slice contains 3 g of fat and 50 calories. 3 g fat contains 27 calories, meaning that 27 of the total 50 calories, or 54%, are from fat.
Items purchased in health food stores are healthier.	Labeling an item "all natural" is not a regulated health claim and therefore no legal definition exists. Health food store products are often more expensive and generally not any more healthy than foods found in supermarkets.
Cholesterol-free means a product is heart healthy.	Products labeled cholesterol-free may still contain saturated and trans fats. These fats can elevate blood cholesterol much more than cholesterol found in foods.
Frozen and canned vegetables have no nutritional value.	Vitamins may be lost due to heat, light, and oxygen and through the canning process. Frozen vegetables typically have the most nutrients followed by fresh vegetables. Canned vegetables may not have as much vitamin C; however, other less-labile nutrients and fiber are still available to be ingested.
Fad diets work for permanent weight loss.	Fad diets may induce some quick initial weight loss (mostly from water losses) because these diets are often lower in calories than most Americans are accustomed to consuming. Fad diets promote the elimination of whole food groups, thus decreasing intake of important vitamins/minerals needed for proper health. Most fad dieters abandon these diets and subsequently regain all the weight that was lost. Experts agree that people should adopt a lifestyle approach to weight loss by improving eating and physical activity patterns.
Skipping meals is a good way to lose weight.	Skipping meals deprives the body of important nutrients and may cause fatigue. People often make up for lost intake by consuming more at the next meal or snacking on high calorie/high sugary foods. Eating nutritious, low-calorie foods in response to hunger is recommended.
Eating after 8 PM causes weight gain.	Timing of meals and snacks is not nearly as important as total calorie intake. Your body will store extra calories as fat regardless of the time of day.
Natural or herbal weight loss products are safe and effective.	Products labeled natural or herbal are not necessarily safe or effective. These products do not undergo any prior scientific testing for public safety or efficacy.
Starches are fattening and should be limited when trying to lose weight.	Food like potatoes, rice, breads, and other grains are blamed for the obesity epidemic. The truth is that these foods are <i>complex</i> carbohydrates and provide the body with energy and essential nutrients. <i>Simple</i> carbohydrates (eg, sweets, candies, and cakes) and high-calorie and/or high-fat food (ie, fast foods) can easily lead to excessive calorie intake.

Data sources: (1) Student Nutrition Awareness Campaign (SNAC), University of California at Los Angeles. *Nutrition Myths 101*. Available at: www.dining.ucla.edu/housingsite/dining/SNAC_pdf/NutritionMyths.pdf. Accessed November 12, 2003. (2) US National Institute of Diabetes and Digestive and Kidney Diseases. NIDDK Web site. National Institutes of Health. Available at: www.niddk.nih.gov/health/nutrit/pubs/myths/. Accessed November 12, 2003.

EXHIBIT 22-2

DEBUNKING ADVERTISING CLAIMS FOR WEIGHT LOSS

False or Unsubstantiated Advertising Claim	Debunking Explanation
Dramatic and rapid weight loss. Extremely popular claims, especially when combined with the idea that these dramatic results can be achieved without dieting or exercise.	These claims appeared in approximately 44% of the ads. Many health-care professionals agree that quick weight loss can be dangerous to health and recommend a healthy, sustainable maximum rate of 1 to 2 lb weight loss per week combined with physical activity.
Permanent weight loss can be achieved only if products/supplements are purchased.	In reality, permanent weight loss requires consistent lifestyle changes including healthy dietary choices and physical activity.
Are you tired of fad diets?	The claim apparently is aimed at yo-yo dieters, who want to believe that at last the weight loss they always dreamed of can be achieved if they will purchase the product advertised. In nearly 40% of the advertisements reported by the FTC, language such as scientifically proven or clinically tested was prominent, or the ad used the credentials of doctors to promote the product. Still others used academia to promote their products, claiming that these products were tested at a major university and spoke of studies or clinical trials with little to no documentation of any research conducted. In nearly 25% of the advertisements, healthcare professionals were used to endorse the products, yet compensation for their endorsement was not disclosed. In some cases, these healthcare professionals did not even exist.
Money-back guarantees.	This is another popular promotional tool used in 50% of advertisements. Claims like 100% proven to work, especially when used in conjunction with language such as all natural, further propagate the myth that natural products are inherently safer than over-the-counter medications or prescription drugs.
Before and after testimonials.	This is another distinct category of deceptive advertisements, these kinds of testimonials were used in approximately 39% of the advertisements reviewed. The FTC report explains that, in many situations, the person testifying just changed clothes, smiled, and stood up straight in the dramatic after pictures. These techniques (use of testimonials and before-and-after photographs) increased by 76% and 48%, respectively, from 1992 to 2001.

FTC: Federal Trade Commission

Data source: The Federal Trade Commission. *Weight Loss Advertising: An Analysis of Current Trends*. Washington, DC: Federal Trade Commission; September 2002. The Federal Trade Commission Staff Report.

the diet. The ingredients (often in the form of tablets, capsules, soft gels, liquids, or powders) may include vitamins, minerals, herbs or other botanicals, amino acids, and substances such as enzymes. The Dietary Supplement Health and Education Act requires that supplement manufacturers ensure that the product is safe and the label is truthful and not misleading. The US Food and Drug Administration may take action against a dietary supplement only when the agency has proven it unsafe. While the use of most dietary

supplements is not associated with any serious health effects, certain dietary supplements—especially ones marketed for physical activity performance enhancement and weight loss—do pose a potential medical threat. One such product line is the ephedra-containing supplements. The Food and Drug Administration took action in 2003 to ban ephedra from the US market, but it remains available, through the Internet and other means, from overseas and black-market suppliers.

EXHIBIT 22-3**INDICATORS OF FAD DIETS**

Indicators that a particular diet is probably fad:

- Promise weight loss without exercise.
Permanent weight loss is impossible without exercise.
- Set unrealistic timelines, such as losing 10 pounds in 7 days.
Many diets can and do produce rapid weight loss. This is simply the result of eating fewer calories. Many call for the elimination of some food group or odd combinations of foods. The diets are almost impossible to follow for a short time, much less a lifetime.
- Claim to have “scientific evidence.”
Any claimed scientific evidence is taken out of context. Anyone can write a book and anyone can claim scientific evidence, but it does not necessarily have to be true.
- Rely on anecdotal evidence.
- Recommend odd food quantities or combinations or set rigid menus.
- Include high membership costs.
- Include fad diet buzzwords: breakthrough, cure, easy, effortless, exotic, fast, guaranteed, magic, miracle, new discovery, quick, secret.
- Fall into four main categories: take a pill, drink a liquid, buy special foods and supplements, and omit certain food groups.

A survey of 2,212 men, ranging in age from 18 to 47 years who entered US Army Special Forces and Ranger training schools in 1999, revealed that 64% of them were using some type of dietary supplement; 35% of them reported daily use. The most commonly used supplements included multivitamins and minerals, protein powders, and ephedrine-containing products.³⁵ Ephedrine-containing supplements were among the weight-loss products used. Of enlisted soldiers reporting dietary supplement consumption, 46% experienced palpitations, and 30% reported dizziness or confusion. The RAND Corporation (Santa Monica, Calif) conducted a study of ephedra in 2003, commissioned by the US Department of Health and Human Services, for the purpose of evaluating the safety and efficacy of ephedra and ephedrine for weight loss and athletic performance. The RAND study concluded that the use of ephedra-containing dietary supplements is associated with a 2- to 3-fold greater risk of nau-

sea, vomiting, heart palpitations, and psychiatric symptoms (eg, anxiety and mood changes). These negative symptoms are seen especially when the supplement is taken with other stimulants (eg, caffeine).³⁴

Manufacturers responded to the 2003 ban on ephedra in US markets by shifting their product lines to ephedra-free products.³⁶ However, the ephedra-free products are not necessarily safer. For example, *Citrus aurantium* (called bitter orange) is an ingredient in many ephedra-free supplements that contains synephrine, which some evidence indicates may cause hypertension or cardiovascular toxicity.³⁷

Another typical ingredient is yohimbe, a tree bark containing the chemical yohimbine. In typical doses of 15 to 30 mg/d, yohimbine may cause insomnia, anxiety, hypertension, tachycardia, dizziness, headache, nausea, and vomiting. Larger doses of yohimbine may result in severe hypotension, cardiac failure, and death.³⁷ Yohimbe is contraindicated if a number of conditions exist and can increase the side effects of many other medications, including those for diabetes.

Like ephedra-containing products, ephedra-free products also contain ingredients rich in caffeine, such as cola nut, guarana, and mate. There may be an increased risk for adverse events when herbs and supplements with stimulant properties are combined.³⁷ Ephedra, bitter orange, and yohimbe are just a few of the popular ingredients that are contained in dietary supplements marketed for weight loss.

The Internet is a popular source for dietary supplement information. A search on the Internet will provide more than 500,000 site references for dietary supplements related to athletic performance enhancement and weight loss. A review of 338 Web sites found that all made one or more health claims, and more than one half omitted the standard federal disclaimer.³⁸ Soldiers indicate that they use the Internet to obtain dietary supplement information; they also read magazines and talk to their peers. They rarely ask their healthcare provider for information regarding dietary supplements. It is imperative, however, that all healthcare providers question recruits about their consumption of dietary supplements. If a recruit indicates use of dietary supplements for weight loss, the healthcare provider should discourage the use of these supplements because of the lack of reliable evidence and the potential for adverse events. The recruit should be provided with safe and effective weight-loss approaches (as described in this chapter).

TABLE 22-9
CLAIMS, EFFICACY, AND SAFETY OF SELECTED DIETARY SUPPLEMENTS

Product	Claims	Efficacy and Safety
L-Carnitine	Burns fat to aid in weight loss.	Insufficient evidence for weight loss. No serious adverse effects associated with doses of 0.5–6.0 g/d. Adverse effects include nausea, vomiting, abdominal cramping, heartburn, gastritis, and seizures with larger doses.
Chitosan	Traps fat to promote weight loss.	Possibly ineffective for weight loss. Allergic reaction in individuals with allergies to shellfish. Long-term use may cause nutrient deficiencies.
Chromium picolinate	Increases insulin sensitivity. Decreases body fat.	Likely safe when used orally and appropriately. Possibly ineffective for weight loss.
<i>Coleus forskohlii</i> (forskolin)	—	Insufficient reliable information available.
DHEA	Promotes weight loss.	More research is needed to determine if use is safe and improves athletic performance.
Ephedrine alkaloids (ma huang, ephedra)	Raises metabolism. Aids in weight loss.	Unsafe; banned in the US. Few to no data support benefit for long-term weight loss.
Green Tea (Chinese tea)	—	Likely safe.
5-HTP	Reduces carbohydrate cravings and aids in weight loss.	Possibly unsafe when used orally. Insufficient reliable research.
Pyruvate	Weight loss.	Insufficient reliable information.
Synephrine (found in <i>Citrus aurantium</i> [bitter orange])	Increases metabolic rate.	May cause hypertension or cardiovascular toxicity. No credible research or scientific results to support manufacturers' claims.

DHEA: dehydroepiandrosterone

5-HTP: 5-hydroxytryptophan

—: no information available

Data sources: (1) *Natural Medicines Comprehensive Database*. Available at: <http://www.naturaldatabase.com>. Accessed November 22, 2003. (2) Fragakis A. *The Health Professional's Guide to Popular Dietary Supplements*. 2nd ed. Washington, DC: American Dietetic Association; 2003.

EATING IN DINING HALLS AND OPERATIONAL ENVIRONMENTS

The nutritional requirements of training experienced by enlisted and officer recruits can be met by the menu selections available in military dining facilities and operational settings. The recruit environment—with increased mental and physical stressors, limited time to eat, and misconceptions about quick energy sources—may hinder adequate intake. As the primary source of sustenance three times per day, these meal environments impose a significant influence that shapes future eating behaviors.

The Dining Hall

Military dining hall menus incorporate recommendations from *Dietary Guidelines for Americans* in

the nutrient distributions of total calories: 50% to 55% carbohydrate, 10% to 15% protein, and less than 30% fat.³⁹ Each military service offers a cycle menu, designed to repeat at specific intervals. To meet the nutritional requirements of the recruit population, the cycle menus are based on the military dietary reference intake (MDRI) values. The MDRI represents quantitative estimates of nutrient intake used in planning and assessing diets for healthy military men and nonlactating, nonpregnant women.^{39,40} The MDRI for energy reflects the average needs of men and women of specific body weights.⁴⁰

Healthy menu selections provide reduced-calorie items and, as such, are appropriate for recruits with weight-management considerations. The healthier

options are available for different menu categories (eg, entrée, vegetable, salad, beverage, and dessert). These menu options should be identified and labeled reflecting, at a minimum, the calorie and fat contents of each portion. Generally, healthy menu entrées provide less than 15 g of fat; nonentrées contain less than 5 g of fat. The healthy menu options should provide approximately 1,800 to 2,100 kcal/d; however, each military service prescribes the implementation procedures and exceptions to policy for reduced-calorie menus.³⁹

Additional suggestions that may reduce the overall calorie intake, without compromising the volume of food or beverages consumed, include the following:

- select baked vs fried items;
- utilize low-fat salad dressing and milk products;
- consume fiber-rich foods, such as fresh salad items, fresh fruit, and whole-grain products;
- select alternatives to high-fat, high-sugar desserts; and
- choose items without sauces, gravies, butter or margarine, syrups, etc.

The Operational Environment

Individual and group feeding rations used in the operational or field environment may be described as general purpose rations.⁴¹ The MRE is an individual ration, with vegetarian and kosher or halal varieties available (kosher foods meet strict Jewish guidelines; halal foods meet strict Islamic guidelines). Group feeding rations include T-rations, unitized group rations, and unitized B-rations.^{39,41} Operational rations are designed to be nutritionally adequate; the energy contribution of MREs, unitized group rations, and B-rations average about 1,200 kcal/meal or about 3,600 kcal/daily ration.^{41,42}

There are effective strategies to maximize performance when consuming general purpose rations.⁴³ Recommendations include the following:

- eating a high-carbohydrate diet (60% of total calories);
- keeping the fat intake low;
- keeping protein intake at approximately 10%;
- consuming small, frequent meals;
- eating from all components of field rations; and
- meeting fluid needs (varies with the environment).

To reduce overall calorie intake of operational rations (while ensuring nutritional balance), it is essential to consume 50% to 60% of each meal component. Any unopened dry items serve as a readily available energy source to be consumed if needed.⁴³ The moderate fiber content of field rations may prevent constipation while still providing good sources of complex carbohydrates, such as those found in whole-wheat pouch bread, fruits, potatoes, stews, and rice-containing entrées.⁴¹

For enhanced performance during training and beyond, the recruit must become aware of food-intake behaviors. Easily consumed foods and beverages, selected when little time is available for meal consumption, tend to be higher in calories and fat than the healthier, low-fat or higher fiber items. This selection practice becomes more troublesome when carried beyond the 6-month recruit-training period, when there is a greater availability of foods and extended meal periods. Consequently, this situation may give rise to overeating tendencies, the conditions of overweight and obesity, and their associated medical complications.

NUTRITION AND EXERCISE

Every individual should exercise, not only for weight loss, but also for general health maintenance. Regular exercise has many health benefits, some or all of which occur with or without weight loss (Exhibit 22-4). However, an estimated 70% to 80% of adult Americans do not get enough exercise to derive any health benefits.⁴⁴ Neither do children or teenagers get enough exercise. Physical education is often no longer mandatory: fewer than 30% of students participate in daily physical education.⁴⁵ More than 33% of high school students do *no* regular physical activity. Many military recruits fall into this category.

The amount of structured exercise that a person needs depends greatly on the rest of his or her daily

activities. For example, an overweight personnel clerk will need more structured exercise than an overweight combat engineer. The minimal recommended amount of exercise is 1,000 kcal/wk. This equates to walking 2 mi/d, 5 d/wk.⁴⁶ Experts recommend 2,000 to 3,000 kcal burned/wk from exercise.⁴⁷ This amounts to approximately 30 to 45 minutes of physical activity on most days of the week. The more intense the exercise, the more calories burned during that time.

Good nutrition enhances the benefits of exercise. For someone not trying to lose weight, no special nutritional changes are required; just follow what is outlined in other sections of this chapter. For energetic men and women who exercise more and therefore expend

EXHIBIT 22-4**BENEFITS OF EXERCISE**

- Burns calories, facilitating weight loss.
- Preserves lean body mass when losing weight.
- Improves sleep and alertness.
- Increases cardiac output, leading to improved heart health.
- Lowers blood pressure and cholesterol.
- Lowers risk of diabetes.
- Lowers risk of gallstones.
- Reduces risk of colon cancer and diverticular disease.
- Prevents or reduces pain of arthritis.
- Improves bone health.
- Increases body's capacity to burn fat.
- Builds and preserves muscle, thus increasing strength.
- Lowers tension, anxiety, depression, and stress.
- Enhances capacity for work and recreational activities.
- Improves physical appearance and self-esteem.
- Improves fitness, leading to a stronger, more flexible body and improved stamina.

Data sources: (1) Gaesser G, Kratina K. *Eating Well, Living Well When You Can't Diet Anymore*. Parker, Colo: Wheat Foods Council; 2000. Leibman B. The benefits of exercise. *Nutrition Action Health Letter*. Washington, DC: Center for Science in the Public Interest; January/February, 1999. (2) Institute of Medicine. *Weight Management: State of the Science and Opportunities for Military Programs*. Washington, DC: National Academies Press; 2003.

more calories, specific nutritional recommendations are available that can help maintain or improve performance. Recruits training for combat require good nutrition to reduce recovery time, increase energy, decrease loss of muscle mass during training, increase stamina, decrease body fat, and ultimately improve performance. Exercise should not be a chore, nor should it be painful. The multiple benefits of regular physical activity go far beyond the weight scale. Good nutrition makes exercise more enjoyable, and exercise enhances the effects of good nutrition.

Sources of Energy-Producing Fuel

Carbohydrates, fats, and amino acids (the building blocks of proteins) all drive the Krebs cycle (or the citric acid cycle—a metabolic pathway) to produce

energy. Energy (or calorie expenditure) depends on multiple factors. Muscle burns more calories than fat; therefore, someone with a lower body-fat percentage and higher muscle mass will burn more calories than someone of the same weight with the opposite body composition. This is why men usually burn more calories than women, and younger people burn more calories than older. Higher intensity training sessions, longer workouts, and consecutive days of training will increase energy needs. The more an individual trains, the more energy he or she will need.⁴⁸

Carbohydrates

Carbohydrates are the body's preferred source of energy. The only nutrient the brain can use is glucose (a carbohydrate). In times of need, the body pulls glucose from the blood, liver, and muscle. Glycogen is the stored form of carbohydrate. For an average 150-pound man, 1,400 kcal are stored as muscle glycogen, 320 as liver glycogen, and 80 as blood glucose. That same 150-pound man has about 60,000 to 100,000 kcal of stored fat. Fat is not the preferred fuel source for endurance activities, but it is for low-level activities (eg, walking). The more strenuous the exercise, the more the body relies on glycogen and the less it relies on fat. Sprinting exercises rely solely on glycogen.⁴⁸

It is equally important for recruits in training to increase endurance, and for those seeking to gain muscle mass to eat adequate carbohydrates. Both types of recruits depend on muscle glycogen for adequate energy, and a diet too high in fat or protein will lead to muscle glycogen depletion. Inadequate daily carbohydrate intake will leave the recruit feeling chronically fatigued and unable to train successfully.⁴⁸ "Carbo loading" refers to saturating muscles with carbohydrates to prepare for a long endurance (90-min) event. Recruits should maintain their normal high-carbohydrate (60%–70%) diet and gradually reduce their training 2 weeks before an endurance event.

Proteins

Protein is essential for repairing damaged muscle fibers and tissues, maintaining nitrogen balance, and preventing infection. Protein is the body's least preferred source of energy, however. Muscle structure is compromised if protein is being used for energy. Much of the research on protein needs involves athletes, many of whom have training needs similar to that of service members preparing for combat. A more trained athlete will need less protein than a new athlete, and a teenage athlete needs more protein than an adult athlete. Individuals gain muscle mass at different stages

of their lives, when the body is ready. Some younger recruits become frustrated when they find that they are not as big as their fellow recruits. Most men do not finish growing until they reach 25 years of age. No supplement or special diet can change that fact.⁴⁸

Excessive protein with inadequate carbohydrate can result in dehydration and ketosis (which occurs when the liver has been depleted of stored glycogen and switches to a fasting mode). Too much protein, regardless of carbohydrate intake, can result in gout, kidney stones, calcium losses, and high cholesterol if protein sources are high in saturated fat.⁴⁸

Fats

Besides providing a stored form of energy, fats make hormones, keep the skin healthy, aid in growth and development, and store fat-soluble vitamins. Adipose tissue (body fat) protects internal organs, maintains body temperature, and produces an essential factor for blood clotting. Fat delays the use of glycogen, delays fatigue, and is a main fuel source for long-distance or endurance activities. Too much fat on the body or in the diet is never desirable, but the active individual needs a healthy balance of both.⁴⁸

Recruits should have about 25% of their caloric intake coming from fat. A diet containing less than 15% fat will impair performance.⁴⁸

Fitness and Nutrition Programs

Fitness and nutrition programs are conducted on many levels. Most programs focus on service members who are beyond the recruit phase, but are often available and appropriate for recruits as well. Examples of nutrition and fitness programs at the installation level include fitness center classes, nutrition and exercise counseling, and incentive programs. Specific examples of these types of programs include the following:

- Army
 - Weigh to Stay Program
- Navy
 - ShipShape
 - Fitness Enhancement Program
 - Crews Into Shape
- Air Force
 - Sensible Weigh Program
 - Lifestyle, Exercise, Attitudes, Relationships, Nutrition (LEARN) Program
 - Healthy Living Workshop
 - Body Composition Improvement Program
 - Shape Your Future . . . Your Weigh! (Attachment 3).

Although standard nutrition and fitness programs are accessible on all military installations, implementation may vary depending on the population and resources available (see Attachment 1).

Each military service has a mechanism for planning, implementing, and evaluating nutrition and fitness counseling and programs. The counseling and programs may be located within a health and wellness center, health promotion office, or fitness center, or provided by a dietitian within the medical treatment facility. However, a variety of organizations may provide nutrition and/or fitness programming, particularly morale, welfare, and recreation fitness centers; wing education and training flights (eg, Airman Leadership School); family support centers; child development centers; chapels; and departments within medical treatment facilities (eg, nutritional medicine or nutrition care division, physical therapy, and behavioral health). Awareness, education, and skill development interventions that target different segments of the population at varying levels of the healthcare continuum (primary vs tertiary prevention) enable experts to assist organizations, groups, and individuals in achieving and maintaining a healthy weight and fitness level.

An overall strategic plan for nutrition is needed to optimally coordinate the programs of multiple agencies to heighten members' awareness of effective strategies to prevent weight gain, lose weight and keep it off, and stay fit. Well-planned programming enables individuals to receive sound nutrition and exercise information in a variety of positive settings that may empower them to make constructive lifestyle changes.

Healthcare Services

Healthcare providers play a key role in assessing and addressing nutritional issues, including overweight and obesity. Routine, preventive, and wellness visits provide the opportunity to address body weight and weight-gain trends. In healthy-weight individuals who exhibit weight-gain trends, addressing the prevention of weight creep is essential because gradual weight gain can, over time, result in overweight or obesity and related chronic diseases. Appropriate options for intervention may include improving patient awareness, providing applicable handouts and self-help aids, and counseling by nutrition or fitness experts and healthcare professionals. In patients with unhealthy weights, a range of interventions may be available and appropriate, such as referral for an exercise prescription, medical nutrition therapy, health and wellness center classes or programs, or behavioral health counseling.

The primary healthcare team has the unique opportunity to facilitate prevention through education and intervention. Most civilians and all active duty service members will have at least one contact annually with their healthcare providers. Because excess weight is an independent risk factor for heart disease, the healthcare team has an important role in the identification and management of these patients.⁴⁹ Several characteristics of the healthcare setting make it an ideal venue for addressing these health risks:

- Improved health is the medical treatment facility's primary mission.
- Healthcare providers are generally viewed as credible sources of information and advice.^{50,51}
- Weight loss is more likely to be sustained if it is supported by periodic contacts from healthcare professionals.⁵²

Patients want more dietary and exercise advice and goal-setting recommendations from their physicians, but only a minority actually discuss these topics with them.⁵³ Clinicians are in a key position (because they have direct access and the stature and authority) to encourage patients to improve behaviors related to diet, exercise, and weight.⁵⁴ The chronic nature of weight-related disease, combined with the mission of the healthcare setting, makes an ongoing relationship with the healthcare team ideal.

Approximately 25% of the people who enter a primary care clinic for any type of medical treatment are moderately overweight or obese (BMI > 27.3).⁵⁵ The typical primary care manager, treating 30 people a day, could provide intervention for 38 individuals at increased health risk in a typical week. In a busy medical treatment facility, however, time is at a premium.

NUTRITIONAL DISORDERS

Osteopenia and Osteoporosis

Osteopenia and osteoporosis are nutritional disorders characterized by decreased bone mineral density (BMD). Osteopenia is defined as a BMD that is 1 to 2.4 standard deviations below the young-adult, gender-matched mean.⁶⁰ Osteoporosis, a worse condition, is defined as a BMD that is 2.5 or more standard deviations below the mean.⁶⁰ A diagnosis of osteoporosis is associated with increased risk of skeletal fractures. Estimated national direct expenditures for osteoporosis and related fractures are \$14 billion yearly.⁶¹

In the United States, 10 million people suffer from osteoporosis, and 34 million more have low bone

The range of opportunities for improvement should be on a continuum and individualized, depending on the patient and the nature of the visit. The opportunities may range from adopting BMI as a vital sign to optimizing support services for more intense interventions. Primary care clinicians may conduct counseling or refer to other specialists (eg, dietitians).⁵⁶

Although most healthcare providers agree that addressing weight is important for good health, barriers such as lack of training, supportive information, and confidence in their ability to provide weight-management counseling can account for a reluctance to include weight and exercise as part of the healthcare routine.^{49,57} Reducing or eliminating these barriers may be as simple as engaging support services to maximize healthcare provider effectiveness. Furthermore, extensive training in weight counseling is not necessary for healthcare providers to have an impact. Physician advice alone to lose weight will increase the likelihood that patients will attempt to control their weight.⁵⁸ This impact expands with the ability to make use of the multiple disciplines available in the healthcare setting (eg, nurses, technicians, behavioral health consultants, and dietitians). Recognition that small changes made by individuals have a significant impact on health at the level of population health⁵⁷ may encourage the healthcare team to increase their participation in the fight against overweight and sedentary lifestyles.

Healthcare professionals should view treatment of eating behavior, encouragement of exercise, and prevention of weight gain as core principles in good healthcare.⁵⁹ The primary healthcare environment may provide a supportive and structured setting to address weight status, weight loss, weight-loss maintenance, and weight-gain prevention.

mass, placing them at increased risk for the disease.⁶¹ Osteoporosis is responsible for more than 1.5 million fractures annually.⁶¹ Although this may appear to be a problem associated only with older individuals, many of the contributing factors are evident in young populations (eg, military recruits).

Today's young women merit specific concern regarding osteoporosis and osteopenia. Lifestyle habits, such as low physical activity and tobacco use coupled with common dietary trends greatly increase the risk for low BMD.⁶² Chronic dieting and eating disorders can limit overall intake of vital nutrients. Restriction of dairy products (in the hope of decreasing caloric intake) is often combined with overuse of caffeine and phosphate-containing

carbonated diet sodas, which may leach calcium out of the bones during a critical phase of bone development.

Bone Mineral Density

Bone density is a measure of mineralization in the skeletal system. In women, 99% of final BMD is achieved by approximately 22 years of age, but gains continue until the late second or early third decade of life.⁶³ In men, BMD peaks by age 29.⁶⁴ With age, BMD declines because of decreases in physical activity, alterations in hormone status, and loss of muscle mass. Men and women have similar BMDs until age 50, after which women typically lose BMD at an increased rate compared with men.⁶⁵

Factors That Affect Bone Mineral Density

Genetics. Heredity may account for 50% to 80% of the variation in peak bone mass.⁶⁶⁻⁶⁸ Black people of African descent have higher average BMDs than Caucasians, who in turn have higher average BMDs than Asians.⁶⁷ In general, a small body frame is associated with increased risk for osteopenia and osteoporosis. Some ethnic differences in BMD begin in utero, possibly because of metabolic differences during growth, and likely involving vitamin D and parathyroid hormone levels.⁶⁷

Hormones. Hormonal status plays a large role in BMD development in women and a lesser role in men. Estrogen-related menstrual disturbances (eg, menopause and amenorrhea) are associated with a profound loss of bone mass.⁶⁸⁻⁷¹ In men, testosterone levels may influence BMD through mediating factors such as growth hormone levels⁷² and antiapoptotic effects on osteoblasts.⁷³ Hypogonadic males have been shown to have low BMD levels.^{74,75}

Tobacco. Smoking is associated with a decrease in BMD and a corresponding increase in osteoporosis risk.^{76,77} Even exposure to second-hand smoke while a youth affected BMD by 2% to 8%.⁷⁸

Exercise. Bone is in constant flux; it undergoes a continual process of resorption and formation called remodeling.⁷⁹ Exercise affects bone strength through accelerating the process of remodeling.⁷⁹⁻⁸¹ Bone remodeling begins about 5 days after the start of a new exercise pattern. Bone resorption leads the process, and subsequent bone formation continues for approximately 6 months.⁸² The period during which remodeling rates change is called the bone-remodeling transient.⁸⁰ Moderate weight-bearing exercise, in conjunction with adequate calcium availability, allows the body to load more calcium into the bony structures, thus increasing BMD.

In young adults, weight-bearing exercise and physical activity are linked to an increased peak BMD of 2% to 8%.⁸³⁻⁸⁵ After peak BMD is attained, weight-bearing activity can halt or slow bone loss associated with the aging process.^{75,86-89} Despite the positive benefits of weight-bearing exercise on increasing BMD, high-impact or high-intensity exercise may increase the occurrence of stress fractures.^{87,90,91} Optimal exercise for improving BMD involves moderate levels of regular weight-bearing activities, such as walking, running, or weight lifting.

During remodeling, bone is fairly porous because of the increased rates of resorption and formation.⁸² This porosity can render the bone susceptible to injury. Bone remodeling can result in lower BMD if resorption takes place more rapidly than formation.⁸⁰ This imbalance can occur when inadequate calcium is available or during very high-intensity, high-impact exercise programs. High bone resorption can increase the risk of injuries such as stress fractures (an overuse injury that effects as many as 30% of military trainees).^{90,91} Low calcium or dairy food intake is associated with increased risk of stress fractures because of decreased BMD.⁹²

Diet. Several dietary factors play an important role in achieving and maintaining peak bone mass. Chronic dieting, weight loss after 18 years of age, and low BMI are all associated with low BMD.⁶¹ These effects may be the result of lower intake of nutrients, as well as decreased mineral-loading of bone associated with reductions in body mass. Calcium and vitamin D (calcitriol, the second step in the biological conversion of vitamin D₃ to its active form) are the primary dietary factors involved in bone remodeling.

Calcium Intake. Calcium is the most abundant mineral in the human body and accounts for 1.5% to 2% of body weight.⁹² Approximately 99% of calcium is found in bone; the remainder is found in the muscular, nervous, and circulatory systems.⁹² A higher intake of calcium during childhood is linked to increased peak BMD, and the sparing effect of dietary calcium on BMD is seen throughout life, even after peak BMD has been achieved. Women aged 18 to 30 years who consumed supplements of approximately 500 mg of calcium/day showed attenuated losses of their total body BMD over 6 months.⁹³ A metaanalysis of 33 studies revealed that supplementation with calcium (1,000 mg/d) decreased BMD losses by 1% per year in 30- to 55-year-old women.⁹⁴

The recommended calcium intake for men and nonpregnant, nonlactating women ages 19 to 50 is 1,000 mg/d.⁹⁵ However, most Americans consume an inadequate amount of dietary calcium: approximately 743 mg/d.⁹⁵ Researchers studying women undergoing

military field training found consumption patterns similar to those of their civilian counterparts.^{93,96} This deficiency may be even more marked in situations involving intense exercise training, as the DRI for calcium does not account for large variation in exercise.⁹²

Obtaining calcium in the diet is fairly simple because several commonly consumed foods contain high levels of calcium. For example, a cup of milk or calcium-fortified juice contains about 300 mg of readily absorbed calcium. On the other hand, calcium is poorly absorbed from foods that are high in phytic acid or oxalates, such as sweet potatoes, spinach, nuts, and beans.⁹⁵ Calcium citrate and calcium carbonate are commonly consumed in over-the-counter calcium supplements. The bioavailability of these calcium salts is enhanced by taking calcium in doses less than 500 mg and by eating when these supplements are taken.⁹⁵

Vitamin D. Vitamin D plays a crucial role in maintaining proper calcium balance in the body. Active vitamin D (calcitriol, a metabolic product of vitamin D) triggers an increase in intestinal absorption of calcium.⁹² Increased plasma calcitriol is associated with an increase in BMD.⁹⁷ In 2000, Sairanen and colleagues⁹⁸ illustrated the benefit of vitamin D supplementation, which resulted in a significant increase in hip BMD, as well as improvements in biomarkers of bone formation. In this study, vitamin D supplementation had to be decreased after 2 years because of hypercalcuria, which is associated with increased risk for nephrolithiasis.^{98,99}

The DRI for vitamin D for men and women aged 19 to 50 years is 5 $\mu\text{g}/\text{d}$.⁹⁵ The average vitamin D intake in this country is considerably lower: only 1.5 to 2.1 $\mu\text{g}/\text{d}$; fortified dairy products are the major source.⁹⁵ However, vitamin D is synthesized by the skin during exposure to sunlight; therefore, actual deficiencies are fairly rare. These deficiencies tend to occur only in those with extremely limited sun exposure, such as young children, elderly and house-bound individuals (especially during the winter), and people living in extreme northern latitudes.¹⁰⁰⁻¹⁰²

Measurement of Bone Mineral Density

Although BMD can be measured by several methods, radiographic and ultrasound techniques are the most common. Ultrasound examinations of the heel or wrist can provide quick, noninvasive information about general BMD levels and may be useful as a screening technique in high-risk individuals. They do not, however, provide specific information on hip and spine BMD—the areas most commonly associated with osteoporotic fractures.¹⁰³

Dual-energy x-ray absorptiometry scans provide precise measurements of BMD. They are also able to measure bone mineral content and provide data regarding soft-tissue composition.^{104,105} A dual-energy x-ray absorptiometry scan involves expensive equipment and exposure to a small amount of radiation ($\sim 20 \text{ mrad}/\text{scan}$), similar to that of a bitewing x-ray examination of the teeth.^{103,105}

Summary of Osteopenia and Osteoporosis

Osteopenia and osteoporosis are common debilitating diseases that affect millions of people today. The peak BMD achieved during youth is the most significant predictor of these disorders in the later years of life. It is desirable to achieve a high BMD to prevent or delay osteopenia, osteoporosis, or both, and to minimize the risk of stress fractures. Although BMD is affected by many factors, diet and exercise have been identified as the two most important that are controllable. Adequate dietary intake of vitamin D and calcium, together with weight-bearing exercise, greatly increases the likelihood of achieving and maintaining optimal BMD.

Anemia

Anemia is a reduction below normal in the blood of the number of erythrocytes, the quantity of hemoglobin (Hgb), or the fraction of blood that consists of red blood cells (RBCs) (ie, the hematocrit). Although often described as a diagnosis, anemia actually refers to a collection of signs and symptoms with significant pathophysiological significance. The major clinical repercussion of anemia is the resulting tissue hypoxia. Severe anemia is associated with weakness, fatigue and fatigability, drowsiness, and irritability; ultimately, death can occur. Blood loss, decreased RBC production, and increased RBC destruction (ie, hemolysis) are the three main causes of anemia. Although blood loss should be the primary consideration when evaluating anemia, increased RBC destruction or reduced production are often involved.

Complicating the process of diagnosing anemia is the fact that normal Hgb distribution varies with age, gender, stage of pregnancy, altitude, history of smoking, and possibly even race.^{106,107} Therefore, the definition of anemia may vary among references. In this chapter, the following values published by the World Health Organization are used:¹⁰⁶

- Normal Hgb is 16 (± 2) g/dL in men and 14 (± 2) g/dL in women.
- Normal Hct is 47% (± 5) in men and 42% (± 5) in women.

- For ages > 15 years, anemia is defined as a Hgb concentration < 13 g/dL in men, < 11 g/dL in pregnant women, and < 12 g/dL in nonpregnant women.

Evaluating RBC morphology is a useful approach when RBC production deficits are suspected. Normocytic-normochromic anemia is characterized by the accelerated destruction or loss of RBCs as seen in hemolytic anemia, hemorrhage, and certain aplastic anemias. Microcytic-hypochromic RBCs suggest an alteration in heme or globin synthesis as seen in iron deficiency, thalassemia, and anemia of chronic disease. In contrast, macrocytic-normochromic anemia suggests a defect in DNA synthesis as seen in vitamin B₁₂ (cobalamin) or folate deficiency.

Iron Status Assessment

Iron deficiency anemia (IDA) is recognized fairly easily, using Hgb concentration and differential criteria, to rule out causes other than iron deficiency. Identifying early stages of iron deficiency is more difficult. Clinical criteria, such as plasma ferritin (which is expected to be decreased in all three stages of iron deficiency), can be falsely elevated by stress, infection, trauma, iron overload, viral hepatitis, and certain cancers.¹⁰⁸ Therefore, several models have been developed using multiple criteria for identifying iron deficiency.¹⁰⁹ An abnormal value for at least two of the following three indicators (serum ferritin, transferrin saturation, and free erythrocyte protoporphyrin) can be used to define iron deficiency.³ Persons with iron deficiency and a low Hgb likely have IDA.¹¹⁰

One laboratory tool for identifying iron deficiency is the serum transferrin receptor (TfR) concentration. When the iron supply is inadequate, an up-regulation of TfRs enables cells to compete more effectively for iron. The number of membrane receptors is proportional to the receptors found in plasma; thus, an increase in TfR is seen in patients with iron-deficient erythropoiesis or with IDA.¹¹¹ Additionally, TfR has been shown to be sufficiently sensitive to differentiate anemia of chronic disease from IDA.¹¹²

Effects of Iron Deficiency

The effects of iron deficiency are far reaching and have clinical significance, even during early stages of iron deficiency, before overt anemia develops. Iron deficiency is associated with physical impairment and reduction in work capacity and productivity,¹¹³ as well as increased morbidity from infectious disease because of adverse effects on the immune system.^{114,115}

Iron-Deficiency Disorders

Iron-deficiency disorders occur when the iron available is insufficient for proper heme synthesis within the body. This is caused by too little iron in the diet, poor absorption of iron by the body, and/or loss of blood (including heavy menstrual bleeding). The spectrum from early deficiency to overt IDA is often described in three stages: (1) iron depletion, (2) iron-deficient erythropoiesis, and (3) IDA.¹¹⁶

The first stage, iron depletion, is characterized by a decrease in iron stores without any effect on iron essential body processes. Ferritin, the storage form of iron in the body, is decreased along with a subsequent increase in the iron-binding capacity of transferrin (the primary protein for iron transport in the body).

The second stage of iron deficiency, iron-deficient erythropoiesis, occurs when inadequate iron is available to the erythroid marrow and tissues for normal biochemistry and function. Serum observations during the second stage of iron deficiency are low serum iron, reduced transferrin saturation levels and increased serum transferrin, and high levels of free erythrocyte protoporphyrin. Serum TfR increases during this stage.¹¹⁷ Iron-deficient erythropoiesis has usually been defined as the stage in which iron deficiency begins, sometimes referred to as functional iron deficiency.¹¹⁸

The third stage, IDA, is identified by a significant reduction in Hgb. Characteristic changes in body iron measures are the following:

- increased transferrin,
- decreased percentage of transferrin saturation,
- increased TfR,
- decreased ferritin, and
- decreased concentration of serum iron.

Prevalence of Iron Deficiency

IDA is the most common nutritional disorder in the world. The World Health Organization has estimated that as many as 5 billion people suffer from iron deficiency (80% of the world's population).¹¹⁹ In the United States, the prevalence of iron deficiency is approximately 3% to 4%; however, prevalence of IDA may be as high as 22% among certain high-risk groups, such as females (especially of childbearing age), children, the elderly, African Americans, and Hispanics.^{3,110} The prevalence of iron deficiency in the military may be about the same as that in the general population. However, because the percentages of women and African Americans have increased in the military, the overall iron status of the force is a subject of concern (Exhibit 22-5).

EXHIBIT 22-5**IRON DEFICIENCY IN THE US MILITARY**

Iron deficiency and iron deficiency anemia may play an important role in soldier performance. They have been studied by several researchers who have attempted to determine if the prevalence is higher among military personnel compared with the general population. One report¹ suggests that the prevalence of iron deficiency in military women is similar to that in the civilian population (approximately 10% are iron deficient). But although the prevalence in the general population is low, high-risk groups such as African Americans and minority women are represented in a larger proportion of in the military than in the general population.² The Committee on Military Nutrition Research cited the importance of studying iron deficiency, especially in women, and described the importance of iron deficiency as being of “military concern.”³

(1) US Army Medical Research and Materiel Command. *Health and Performance Research of Military Women*. Frederick, Md: Fort Detrick; 1999. Military Operational Medicine Research Program Fact Sheet. (2) US Department of Defense. *Population Representation in the Military Services*. Washington, DC: DoD; 2000. Available at: <http://dticaw.dtic.mil/prhome/poprep2000/>. Accessed November 1, 2003. (3) Poos M, Costello R, Carlson-Newberry S. *Committee on Military Nutrition Research Activity, Report December 1, 1994 Through May 31, 1999*. Washington, DC: National Academy of Sciences; 1999.

Treatment of Iron Deficiency

Diet. IDA develops because either not enough iron is being consumed or too much iron is being used or expelled. Therefore, assessment of dietary iron consumption is an essential part of the treatment for iron deficiency and IDA. Dietary iron assessment involves total iron consumption and bioavailability of the iron consumed. Typical Western diets contain approximately 6 mg of iron/1,000 kcal and thus will likely meet recommended daily intake values. Iron bioavailability is more important than the total dietary iron in correcting or preventing iron deficiency.¹²⁰

Iron Consumption. Improving total iron consumption involves increasing foods high in absorbable iron, such as liver, kidney, beef, egg yolk, dried fruits, dried peas, beans, nuts, green leafy vegetables, molasses, whole-grain breads, and fortified cereals. Consuming nonheme iron with iron enhancers (eg, cereal and orange juice) or with heme iron and animal protein (eg, rice and chicken) can

maximize iron absorption. Iron absorption may also be improved by decreasing iron inhibitors, such as phytate, oxalate, and tannins.

Iron Bioavailability. Iron absorption is affected by a plethora of dietary and physiological enhancing and inhibiting factors; the combined effect determines the amount of iron absorbed (bioavailability). The primary components that determine iron bioavailability include the following:¹²¹

- current iron status of an individual (iron-deficient individuals have increased absorption of dietary iron),
- type of iron consumed (heme iron is absorbed better than nonheme iron), and
- presence of inhibiting agents (eg, phytates, oxalates, tannins, polyphenolic compounds, and alkaline dietary components) and iron-enhancing agents (eg, ascorbic acid, other organic acids, the presence of heme iron, and the presence of animal protein).

The iron in meat, fish, and poultry products is 40% heme, and approximately 25% of heme iron is absorbed by the body.^{122,123} In contrast, nonheme iron—which includes iron fortificants, iron supplements, plant sources of iron, and the remaining portion of iron in meat—are poorly absorbed (2%–20%).¹²⁴

Medication. Traditional treatment for iron deficiency is with oral iron supplementation via an iron salt such as ferrous sulfate (commonly prescribed as 325 mg, to be taken three times daily). Each dose provides 180 mg of iron, of which 10 to 20 mg is likely absorbed.¹²⁵

Special Military Considerations

Anemia and Diving. Anemia is considered a potentially dive-disqualifying hematological disorder¹²⁶ and has been targeted for further investigation.

Anemia and Flying. Researchers studying oxygen saturation in arterial blood (Sao₂) in children during long airline flights showed that Sao₂ declines significantly with reduced aircraft cabin pressure and concomitant reduced partial pressure of oxygen in the cabin.¹²⁷ Lee et al¹²⁷ concluded in 2002 that, despite no clinically noticeable ill effects in these relatively healthy passengers, persons with preexisting anemia or cardiopulmonary disease are likely to experience greater degrees of clinical compromise with similar degrees of decline in their Sao₂.

Thus, anemia in the aviator, flight crew, and flying population has the potential to greatly impact physical and cognitive performance; consequently, it is of great concern to the military.

Vitamin B₁₂ and Folate Deficiencies

Vitamin B₁₂ (cobalamin, the general term for compounds that contain the dimethylbenzimidazolylcobamide nucleus of vitamin B₁₂) and folate are involved in several essential and interdependent enzymatic reactions. Although ample dietary sources are available for both of these nutrients (Exhibit 22-6), the absence of one or the other may result in conditions that include altered RBCs and profound neurological effects.¹²⁸

Folate requirements are met more from the incorporation of iron and folate into fortified foods, such as breakfast cereals and other grains, than from other sources. This reliance on fortified foods allows at-risk populations (eg, vegetarians) to meet their daily individual requirements.¹²⁹ Much debate has existed in the medical and scientific communities regarding the risks versus the benefits of folate supplementation; however, the benefits from decreasing neural tube defects early in pregnancy are well established. Additionally, folate lowers homocysteine, an independent risk factor for heart disease.¹³⁰

Cobalamin deficiency is relatively uncommon among adolescents and young adults but has been identified in the general population at a prevalence of 3% to 40%.¹³¹ Besides inadequate diet, cobalamin deficiency can be a result of other reasons, such as malabsorption, biological competition for dietary cobalamin, and impaired utilization.¹²⁸ However, folate deficiency is more common in the age group that includes recruits (adolescent to young adult) because their poor consumption of adequate dairy foods, fruits, and vegetables is typical of that age. Only 20% of adolescents surveyed as part of the Youth Risk Behavior Surveillance System consumed at least five daily servings of fruits and vegetables.^{129,132}

For military recruits, the immediate effect of folate deficiency anemia is poor performance in physical activity. A pregnant woman's inadequate folate consumption during the periconception period and into the first trimester of her pregnancy can have life-long

EXHIBIT 22-6

DIETARY SOURCES OF COBALAMIN AND FOLATE

Cobalamin: All animal-based foods (beef, pork, poultry, fish, and dairy) and fortified grain foods¹

Folate: Orange juice, dark green leafy vegetables, asparagus, strawberries, peanuts and legumes, enriched foods (several thousand items; see food label for specifics)²

(1) Stabler S. Vitamin B-12. In: Russell R, ed. *Present Knowledge in Nutrition*. Washington, DC: International Life Sciences Press; 2001: 230–240. (2) Bailey L, Moyers S, Gregory J. Folate. In: Russell R, ed. *Present Knowledge in Nutrition*. Washington, DC: International Life Sciences Press; 2001: 214–229.

implications for the developing fetus.¹³⁰ Additionally, poor folate intake allows elevated homocysteine to affect the vascular system. Several other factors can lead to folate deficiency: increased demand, malabsorption, biological competition for dietary folate, and drug-induced deficiency (oral contraceptives and alcohol are common among the recruit age group).¹²⁸

Megaloblastic changes in the bone marrow are indicative of cobalamin and folate deficiency. There remains some controversy as to the best testing method and sequence for determining if cobalamin, folate, or a combination of the two is the source of the deficiency. Because there are significant risks for not properly diagnosing cobalamin deficiency, testing for both is generally recommended.¹²⁸

Although pharmacological doses of cobalamin or folate will be initially required to treat deficiency, it is important to encourage the increased consumption of foods containing the deficient nutrient. Foods found to be deficient in vitamin B₁₂ are often required to continue supplementation for life. Dietary sources of cobalamin and folate are fairly plentiful (see Exhibit 22-6).

SUMMARY

The huge increase in overweight and obesity in the US population is reflected in today's recruits. Recruits may begin service at a higher weight or body fat percentage than permissible once entry-level training is completed. Many recruits will be successful at losing weight during recruit training because of the controlled environment and high level of physical activity. However, they may begin or reinforce habits that will lead to unhealthy eating and weight gain in the future.

Excess weight is unhealthy, costly to the health care system, and adversely affects readiness.

Like civilians, military service members will often be misinformed about effective ways to control weight while still consuming the macronutrients and micronutrients needed for health and good performance. They may resort to fad dieting, dietary supplements, or other potentially dangerous methods to lose weight. However, weight loss and weight maintenance are best achieved

through a combination of a healthy, balanced diet and regular exercise. A healthy diet should be based on a broad variety of foods, as described in the US Department of Agriculture's Food Guide Pyramid.

To achieve a proper energy balance, the age, gender, and activity level of the person should be considered. Adults should obtain 45% to 65% of their energy (kilocalories) needs from carbohydrates, 20% to 35% from fat, and 10% to 30% from protein. Persons with especially high-energy needs should increase their carbohydrate intake by consuming more complex sugars (and starches), such as those found in grains and vegetables. Even though recruits may be building a great deal of extra muscle through their training, they should not need levels of protein greater than 30% of their energy intake.

Fad diets usually promote the elimination of certain kinds of foods. Although they may result in quick initial weight loss, these diets are unhealthy and are usually abandoned after a short period, with the dieter's consequent weight regain. Nevertheless, fad diets are heavily promoted, and recruits may be easily misled

by their claims. Dietary supplements that promise weight loss or energy enhancement are commercially advertised, readily available, and mostly unregulated. Many supplements contain ingredients with dangerous effects. Ephedra (which is now banned in the United States, but still available), yohimbe, and bitter orange are three of the more dangerous ingredients, particularly when combined with each other or with other stimulants, such as caffeine.

Each military service has effective, structured, weight-control programs that combine diet and exercise under the supervision of registered dietitians. Healthcare providers should be prepared to educate patients about the danger of excess weight and body fat and healthy ways to control them. Healthcare providers should also be aware of other nutritional factors that can affect a recruit's health or performance. Both male and female recruits may suffer from osteopenia, usually from inadequate calcium and/or vitamin D intake, making these recruits susceptible to stress fractures. IDA and other nutrient deficiencies may be caused by poor diet or other factors.

REFERENCES

1. US Department of Health and Human Services. Overweight and obesity threaten US health gains. *HHS News*. Washington, DC: DHHS; 13 December 2001: 1-4. Available at: http://www.surgeongeneral.gov/todo/pressreleases/pr_obesity.htm. Accessed 2 November 2003.
2. US Department of Health and Human Services, Public Health Service, Office of The Surgeon General. *Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity*. Rockville, Md: DHHS, PHS, Office of The Surgeon General; 2001. 02NLM: WD 210 S9593 2001. Available at: <http://www.surgeongeneral.gov/topics/obesity/calltoaction/CalltoAction.pdf>. Accessed 10 November 2003.
3. Centers for Disease Control and Prevention. Iron deficiency—United States. *MMWR*. 2002;51:897-899.
4. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000 [review]. *JAMA*. 2004;291:1238-1245.
5. National Center for Health Statistics, Centers for Disease Control and Prevention. *Prevalence of Overweight Among Children and Adolescents: United States, 2000*. Hyattsville, Md: NCHS, 2003. Available at: www.cdc.gov/nchs/products/pubs/pubd/hestats/over99fig1.htm. Accessed 21 November 2003.
6. Lindquist CH, Bray RM. Trends in overweight and physical activity among US military personnel, 1995-1998. *Prev Med*. 2001;32:57-65.
7. Ma Y, Bertone ER, Stanek EJ, et al. Association between eating patterns and obesity in a free-living U.S. adult population. *Am J Epidemiol*. 2003;158:85-92.
8. Trent LK. Nutrition knowledge of active-duty Navy personnel. *J Am Diet Assoc*. 1992;92:724-728.
9. James DC. Gender differences in body mass index and weight loss strategies among African Americans. *J Am Diet Assoc*. 2003;103:1360-1362.
10. Nolte R, Franckowiak SC, Crespo CJ, Andersen RE. US military weight standards: What percentage of U.S. young adults meet the current standards? *JAMA*. 2002;113:486-490.

11. US Department of the Army. *Standards of Medical Fitness*. Washington, DC: Headquarters, DA; 2003. Army Regulation 40-501.
12. US Department of the Army. *The Army Weight Control Program*. Washington, DC: Headquarters, DA; 10 June 1987. Army Regulation 600-9.
13. US Department of Defense. *DoD Physical Fitness and Body Fat Programs Procedures*. Washington, DC: DoD; 5 November 2002. DOD Instruction 1308.3.
14. US Department of the Army, Training and Doctrine Command. *Enlisted Initial Entry Training (IET) Policies and Administration: United States, 2003*. Washington, DC: Headquarters, DA; 2003. TRADOC Regulation 350-6. Available at: <http://www.tradoc.army.mil/tpubs/regndx.htm>. Accessed 21 November 2003.
15. US Department of the Navy. *Physical Readiness Program*. Washington, DC: Headquarters, DN; 10 October 2002. OPNAV Instruction 6110.1G.
16. Robbins AS, Chao SY, Russ CR, Fonseca VP. Costs of excess body weight among active duty personnel—United States Air Force, 1997. *Mil Med*. 2002;16:393–397.
17. National Heart, Lung, and Blood Institute. Obesity Education Initiative Expert Panel. *NHLBI Obesity Education Initiative Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report*. Bethesda, Md: National Institutes of Health; 1998. NIH Publication 98-4083. Available at: http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf. Accessed 10 November 2003.
18. Robbins AS, Chao SY, Fonseca VP, Snedecor MR, Knapik JJ. Predictors of low physical fitness in a cohort of active-duty US Air Force members. *Am J Prev Med*. 2001;20:90–96.
19. Seidell JC, Flegal KM. Assessing obesity: Classification and epidemiology. *Br Med Bull*. 1997;53:238–252.
20. Nolte R, Franckowiak SC, Crespo CJ, Andersen RE, 2002. Cited by: Food and Nutrition Board, Institute of Medicine. Programmatic and Research Recommendations. In: Subcommittee on Military Weight Management, Committee on Military Nutrition Research. *Weight Management: State of the Science and Opportunities for Military Programs*. Washington, DC: National Academies Press; 2003: 125. Available at: <http://books.nap.edu/books/0309089964/html/index.html>. Accessed 27 August 2003.
21. Food and Nutrition Board, Institute of Medicine. In: Subcommittee on Military Weight Management, Committee on Military Nutrition Research. *Weight Management: State of the Science and Opportunities for Military Programs*. Washington, DC: National Academies Press; 2003. Available at: <http://books.nap.edu/books/0309089964/html/index.html>. Accessed 27 August 2003.
22. Wolf AM, Colditz GA, 1998. Cited by: US Department of Health and Human Services, Public Health Service, Office of The Surgeon General. *Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity*. Rockville, Md: DHHS, PHS, Office of The Surgeon General; 2001: 10. 02NLM: WD 210 S9593 2001. Available at: <http://www.surgeongeneral.gov/topics/obesity/calltoaction/CalltoAction.pdf>. Accessed 10 November 2003.
23. US Department of Defense, 1997. Cited by: Food and Nutrition Board, Institute of Medicine. Military Standards for Fitness, Weight, and Body Composition. In: Subcommittee on Military Weight Management, Committee on Military Nutrition Research. *Weight Management: State of the Science and Opportunities for Military Programs*. Washington, DC: National Academies Press; 2003: 29–55. Available at: <http://books.nap.edu/books/0309089964/html/index.html>. Accessed 27 August 2003.
24. Koplan JP, Dietz WH. Caloric imbalance and public health policy. *JAMA*. 1999;282:1579–1581.
25. Robbins AS, Chao SY, Russ CR, Fonseca VP, 2002. Cited by: Food and Nutrition Board, Institute of Medicine. Programmatic and Research Recommendations. In: Subcommittee on Military Weight Management, Committee on Military Nutrition Research. *Weight Management: State of the Science and Opportunities for Military Programs*. Washington, DC: National Academies Press; 2003: 125-142. Available at: <http://books.nap.edu/books/0309089964/html/index.html>. Accessed 27 August 2003.

26. Hennrikus D, Jeffery R. Worksite intervention for weight control: a review of the literature. *Am J Health Promotion*. 1996;10:471–498.
27. Poston WS, Foreyt JP. Obesity is an environmental issue. *Atherosclerosis*. 1999;146:201–209.
28. Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein and Amino Acids*. Washington, DC: National Academies Press; 2002.
29. Duyff RL. *American Dietetic Association Complete Food & Nutrition Guide*. 2nd ed. Hoboken, NJ: John Wiley & Sons; 2002: 25–28, 74–105.
30. Federal Trade Commission. *Weight Loss Advertising: An Analysis of Current Trends*. Washington, DC: Federal Trade Commission; September 2002. The Federal Trade Commission Staff Report.
31. Student Nutrition Awareness Campaign (SNAC), University of California at Los Angeles. *Nutrition Myths 101*. Available at: http://www.dining.ucla.edu/housingsite/dining/SNAC_pdf/NutritionMyths.pdf. Accessed 12 November 2003.
32. National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). Weight-Control Information Network (WIN). *Weight-Loss and Nutrition Myths*. Available at: <http://www.niddk.nih.gov/health/nutrit/pubs/myths/>. Accessed 12 November 2003.
33. Kaufman DW, Kelly JP, Rosenberg L, Anderson TE, Mitchell AA. Recent patterns of medication use in the ambulatory adult population of the United States: The Slone survey. *JAMA*. 2002;287:337–344.
34. Agency for Healthcare Research and Quality (AHRQ), US Department of Health and Human Services. *Ephedra and Ephedrine for Weight Loss and Athletic Performance Enhancement: Clinical Efficacy and Side Effects*. Washington, DC: DHHS; March 2003. Available at: <http://www.fda.gov/bbs/topics/NEWS/ephedra/summary.html>. Accessed 22 November 2003. Evidence Report/Technology Assessment Number 76. AHRQ Publication No. 03-E021.
35. Arsenault J, Kennedy J. Dietary supplement use in U.S. Army special operations candidates. *Mil Med*. 1999;164: 495–501.
36. Marcus DM, Grollman AP. Ephedra-free is not danger free. *Science* [serial online]. October 2003.
37. Therapeutic Research Center Faculty. *Natural Medicines Comprehensive Database*. Stockton, Calif: Therapeutic Research Center, 2003. Available at: <http://www.naturaldatabase.com>. Accessed 22 November 2003.
38. US Government Accounting Office. *Dietary Supplements for Weight Loss: Limited Federal Oversight Has Focused More on Marketing Than on Safety*. Washington, DC: Government Accounting Office; 31 July 2002. GAO-02-985T. Testimony before the Subcommittee on Oversight of Government Management, Restructuring, and the District of Columbia, Committee on Governmental Affairs, US Senate.
39. US Department of the Army, US Department of the Navy, US Department of the Air Force. *Medical Services Nutrition Standards and Education*. Washington, DC: Headquarters, DA, DN, DAF; 15 June 2001. Army Regulation 40-25, BU-MEDINSTR 10110.6, Air Force Instruction 40-141.
40. Baker-Fulco CJ, Bathalon GP, Bovill ME, Lieberman HR. *Military Dietary Recommended Intakes: Rationale for Tabled Values*. Natick, Mass: US Army Research Institute of Environmental Medicine; 2001. USARIEM Technical Note TN-00/10.
41. Baker-Fulco CJ, Patton BD, Montain SJ, Lieberman HR. *Nutrition for Health and Performance*, 2001. Natick, Mass: US Army Research Institute of Environmental Medicine; 2001. USAREIM Technical Note TN-01/4.
42. Rations. Air Force Medical Service. Available at: https://kx.afms.mil/ctb/groups/dotmil/documents/afms/knowledgejunction.hcst?functionalarea=NutritionalMedicine&doctype=convert&docname=ctb_02400. Accessed 22 November 2003.
43. Rose PL. Operational nutrition. *Briefing to Physicians and Command Fitness Leaders*. Marine Corps Base Camp Lejeune, NC; 2002–2003.

44. Gaesser G, Kratina K. *Eating Well, Living Well When You Can't Diet Anymore*. Parker, Colo: Wheat Foods Council; 2000.
45. Centers for Disease Control and Prevention. *Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Diseases and Obesity*. Available at: http://www.cdc.gov/nccdphp/aag/aag_dnpa.htm. Accessed 26 November 2003.
46. Leibman B. The benefits of exercise. *Nutr Action Health Letter*. 1999; January–February: 1.
47. Food and Nutrition Board, Institute of Medicine. *Weight Management: State of the Science and Opportunities for Military Programs*. Washington, DC: National Academies Press; 2003.
48. Clark N. *Nancy Clark's Sports Nutrition Guidebook*. 2nd ed. Champaign, Ill: Human Kinetics; 1997.
49. Lyznicki JM, Young DC, Riggs JA, Davis RM. Obesity: Assessment and management in primary care. *Am Fam Physician*. 2001;63:2185–2196.
50. Mullen PD, Evans D, Forster J, et al. Settings as an important dimension in health education/promotion policy, programs and research. *Health Educ Q*. 1995;22:329–345.
51. Mercer SL, Green LW, Rosenthal AC, Husten CG, Khan LK, Dietz WH. Possible lessons from the tobacco experience for obesity control [review]. *Am J Clin Nutr*. 2003;77(4 suppl):1073S–1082S.
52. Davis RB, Turner LW. A review of current weight management: Research and recommendations [review]. *J Am Acad Nurse Practitioners*. 2001;13:15–19. Quiz 20-1.
53. Potter MB, Vu JD, Croughan-Minihane M. Weight management: What patients want from their primary care physicians. *J Fam Pract*. 2001;50:513–518.
54. Manson JE, Skerrett PJ, Greenland P, VanItallie TB. The escalating pandemics of obesity and sedentary lifestyle: A call to action for clinicians. *Arch Intern Med*. 2004;164:249–258.
55. Nawaz H, Adams M, Katz D. Weight loss counseling by health care providers. *Am J Public Health*. 1999;89:764–767.
56. Agency for Healthcare Research and Quality (AHRQ), U.S. Preventive Services Task Force (USPSTF). *Behavioral Counseling in Primary Care to Promote a Healthy Diet: Recommendations and Rationale*. Rockville, Md: AHRQ/USPSTF; 2003: 1–12. Available at: <http://www.ahrq.gov/clinic/3rduspstf/diet/dietrr.pdf>. Accessed 2 September 2003.
57. Lazovich D, Curry SJ, Beresford SA, Kristal AR, Wagner EH. Implementing a dietary intervention in primary care practice: A process evaluation. *Am J Health Promotion*. 2000;15:118–125.
58. Galuska DA, Will JC, Serdula MK, Ford ES. Are health care professionals advising patients to lose weight? *JAMA*. 1999;282:1576–1578.
59. Rippe JM, Hess S. The role of physical activity in the prevention and management of obesity. *J Am Diet Assoc*. 1998;98(suppl 2):S31–S38.
60. World Health Organization (WHO). WHO Web site. Geneva, Switzerland: WHO; 2000. Available at: <http://www.who.org>. Accessed 21 August 2000.
61. US Department of Health and Human Services, National Institutes of Health. *Fast Facts on Osteoporosis*. Bethesda, Md: DHHS/NIH; 2003. Available at: www.osteoporosis.org. Accessed 2 Aug 2004. Fact sheet.
62. Holbrook TL, Barrett-Connor E. The association of lifetime weight and weight control patterns with bone mineral density in an adult community. *Bone Miner*. 1993;20:141–149.
63. Teegarden D, Proulx WR, Martin BR, et al. Peak bone mass in young women. *J Bone Miner Res*. 1995;10:711–715.

64. Rico H, Revilla M, Gonzalez-Riola J, Villa LF, Alvarez de Buergo M. Bone mineral content and anthropometric variables in men: A cross-sectional study in 324 normal subjects. *Clin Rheumatol*. 1993;12:485–489.
65. Pumarino H, Lillo R, Oviedo S, Gonzalez P. Bone density and mineral content in normal men: Measurement by dual photon densitometry [in Spanish]. *Rev Med Chil*. 1993;121:1006–1011.
66. Cooper C, Eastell R. Bone gain and loss in premenopausal women. *Br Med J*. 1993;306:1357–1358.
67. Pollitzer WS, Anderson JJ. Ethnic and genetic differences in bone mass: A review with a hereditary vs environmental perspective. *Am J Clin Nutr*. 1989;50:1244–1259.
68. Suleiman S, Nelson M, Li F, Buxton-Thomas M, Moniz C. Effect of calcium intake and physical activity level on bone mass and turnover in healthy, white, postmenopausal women. *Am J Clin Nutr*. 1997;66:937–943.
69. Kirchner EM, Lewis RD, O'Connor PJ. Bone mineral density and dietary intake of female college gymnasts. *Med Sci Sports Exerc*. 1995;27:543–549.
70. Toss G. Effect of calcium intake vs. other life-style factors on bone mass. *J Intern Med*. 1992;231:181–186.
71. Young N, Formica C, Szmukler G, Seeman E. Bone density at weight-bearing and nonweight-bearing sites in ballet dancers: The effects of exercise, hypogonadism, and body weight. *J Clin Endocrinol Metab*. 1994;78:449–454.
72. Ohlsson C, Isgaard J, Tornell J, Nilsson A, Isaksson OG, Lindahl A. Endocrine regulation of longitudinal bone growth. *Acta Paediatr Suppl*. 1993;82:33–40.
73. Falahati-Nini A, Riggs BL, Atkinson EJ, O'Fallon WM, Eastell R, Khosla S. Relative contributions of testosterone and estrogen in regulating bone resorption and formation in normal elderly men. *J Clin Invest*. 2000;106:1553–1560.
74. Amin S, Zhang Y, Sawin CT, et al. Association of hypogonadism and estradiol levels with bone mineral density in elderly men from the Framingham study. *Ann Intern Med*. 2000;133:951–963.
75. Kerr D, Ackland T, Maslen B, Morton A, Prince R. Resistance training over 2 years increases bone mass in calcium-replete postmenopausal women. *J Bone Miner Res*. 2001;16:175–181.
76. Law MR, Hackshaw AK. A meta-analysis of cigarette smoking, bone mineral density and risk of hip fracture: Recognition of a major effect. *Br Med J*. 1997;315:841–846.
77. Valimaki MJ, Karkkainen M, Lamberg-Allardt C, et al. Exercise, smoking, and calcium intake during adolescence and early adulthood as determinants of peak bone mass. *Br Med J*. 1994;309:230–235.
78. Blum M, Harris SS, Must A, Phillips SM, Rand WM, Dawson-Hughes B. Household tobacco smoke exposure is negatively associated with premenopausal bone mass. *Osteoporosis Int*. 2002;13:663–668.
79. Price JS, Oyajobi BO, Russell RG. The cell biology of bone growth. *Eur J Clin Nutr*. 1994;48(suppl):S131–S149.
80. Heaney RP. The bone-remodeling transient: Implications for the interpretation of clinical studies of bone mass change. *J Bone Miner Res*. 1994;9:1515–1523.
81. Johnson BA, Neylon T, Laroche R. Lesser metatarsal stress fractures. *Clin Podiatr Med Surg*. 1999;16:631–642.
82. Beck BR. Tibial stress injuries: An aetiological review for the purposes of guiding management. *Sports Med*. 1998;26:265–279.
83. Branca F. Physical activity, diet and skeletal health. *Public Health Nutr*. 1999;2:391–396.
84. Valdimarsson O, Kristinsson JO, Stefansson SO, Valdimarsson S, Sigurdsson G. Lean mass and physical activity as predictors of bone mineral density in 16–20-year old women. *J Intern Med*. 1999;245:489–496.

85. Vuori I. Peak bone mass and physical activity: A short review. *Nutr Rev.* 1996;54(suppl):S11–S14.
86. Davee AM, Rosen, CJ, Adler, RA. Exercise patterns and trabecular bone density in college women. *J Bone Miner Res.* 1990;5:245–250.
87. Forwood MR, Burr DB. Physical activity and bone mass: Exercises in futility? *Bone Miner.* 1993; 21:89–112.
88. Kelley GA, Kelley KS, Tran ZV. Exercise and bone mineral density in men: A meta-analysis. *J Appl Physiol.* 2000;88: 1730–1736.
89. Ulrich CM, Georgiou CC, Gillis DE, Snow CM. Lifetime physical activity is associated with bone mineral density in premenopausal women. *J Womens Health Gender-Based Med.* 1999;8:365–375.
90. Cline AD, Jansen GR, Melby CL. Stress fractures in female army recruits: Implications of bone density, calcium intake, and exercise. *J Am Coll Nutr.* 1998;17:128–135.
91. Kelly EW, Jonson SR, Cohen ME, Shaffer R. Stress fractures of the pelvis in female Navy recruits: An analysis of possible mechanisms of injury. *Mil Med.* 2000;165:142–146.
92. Clarkson PM, Haymes EM. Exercise and mineral status of athletes: Calcium, magnesium, phosphorus, and iron. *Med Sci Sports Exerc.* 1995;27:831–843.
93. Peterson BA, Klesges RC, Kaufman EM, Cooper TV, Vukadinovich CM. The effects of an educational intervention on calcium intake and bone mineral content in young women with low calcium intake. *Am J Health Promotion.* 2000;14:149–156.
94. Welten DC, Kemper HC, Post GB, van Staveren WA. A meta-analysis of the effect of calcium intake on bone mass in young and middle aged females and males. *J Nutr.* 1995;125:2802–2813.
95. Institute of Medicine. *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride.* Washington, DC: National Academies Press; 1999.
96. King N, Fridlund KE, Askew EW. Nutrition issues of military women. *J Am Coll Nutr.* 1993;12:344–348.
97. Swaminathan R. Nutritional factors in osteoporosis. *Int J Clin Pract.* 1999;53:540–548.
98. Sairanen S, Karkkainen M, Tahtela R, et al. Bone mass and markers of bone and calcium metabolism in postmenopausal women treated with 1,25-dihydroxyvitamin D (calcitriol) for four years. *Calcif Tissue Int.* 2000;67:122–127.
99. The American Dietetic Association. *Manual of Clinical Dietetics.* 6th ed. Chicago, Ill: The American Dietetic Association; 2000.
100. Kokkonen J, Koivisto M, Kirkinen P. Seasonal variation in serum-25-OH-D3 in mothers and newborn infants in northern Finland. *Acta Paediatr Scand.* 1983;72:93–96.
101. Looker AC, Dawson-Hughes B, Calvo MS, Gunter EW, Sahyoun NR. Serum 25-hydroxyvitamin D status of adolescents and adults in two seasonal subpopulations from NHANES III. *Bone.* 2002;30:771–777.
102. Rucker D, Allan JA, Fick GH, Hanley DA. Vitamin D insufficiency in a population of healthy western Canadians. *Can Med Assoc J.* 2002;166:1517–1524.
103. Johnston CC Jr, Slemenda CW, Melton LJ III. Clinical use of bone densitometry. *N Engl J Med.* 1991;324:1105–1109.
104. Madsen OR, Jensen JE, Sorensen OH. Validation of a dual energy X-ray absorptiometer: Measurement of bone mass and soft tissue composition. *Eur J Appl Physiol.* 1997;75:554–558.
105. Sievanen H. A physical model for dual-energy X-ray absorptiometry-derived bone mineral density. *Invest Radiol.* 2000;35:325–330.

106. World Health Organization (WHO). *Iron Deficiency Anemia — Assessment, Prevention and Control*. Geneva, Switzerland: WHO; 2001.
107. Perry GS. Iron nutrition does not account for the hemoglobin differences between blacks and whites. *J Nutr*. 1992;122:1417–1424.
108. Ravel R. *Clinical Laboratory Medicine: Clinical Application of Laboratory Data*. 5th ed. Chicago, Ill: Year Book Medical Publishers; 1989.
109. Johnson MA. Iron: Nutrition monitoring and nutrition status assessment. *J Nutr*. 1990;120:1486–1491.
110. Looker AC, Dallman PR, Carroll MD, Gunter EW, Johnson CL. Prevalence of iron deficiency in the United States. *JAMA*. 1997;277:973–976.
111. Ahluwalia N. Diagnostic utility of serum transferrin receptors measurement in assessing status. *Nutr Rev*. 1998;56:133–141.
112. Ferguson B, Skikne B, Simpson K, Baynes R, Cook J. Serum transferrin receptor distinguishes the anemia of chronic disease from iron deficiency anemia. *J Lab Clin Med*. 1992;119:385–390.
113. Haas JD, Brownlie TI. Iron deficiency and reduced work capacity: A critical review of the research to determine a causal relationship. *J Nutr*. 2001;131(suppl):676S–690S.
114. MacDougall LG. The immune response in iron-deficient children: Impaired cellular defense mechanisms with altered humoral components. *J Pediatr*. 1975;86:833–843.
115. Srikantia SG, Prasad JS, Bhaskaram C, Krishnamachari KA. Anaemia and immune response. *Lancet*. 1976;1:1307–1309.
116. Bothwell T, Charlton R, Cook J, Finch C. Iron metabolism in man. In: *Iron Metabolism in Man*. Oxford, UK: Blackwell Scientific Publications; 1979.
117. Baynes R, Skikne B, Cook J. Circulating transferrin receptors and assessment of iron status. *J Nutr Biochem*. 1994;5:322–330.
118. Expert Scientific Working Group. Summary of a report on assessment of the iron nutritional status of the United States population. *Am J Clin Nutr*. 1985;42:1318–1330.
119. World Health Organization (WHO). *Micronutrient Deficiencies*. Geneva, Switzerland: WHO; 2003. Available at: <http://www.who.int/nut/ida.htm>. Accessed 16 September 2003.
120. Mahan L, Escott-Stump S. *Krause's Food, Nutrition, & Diet Therapy*. 9th ed. Philadelphia, Pa: WB Saunders Co; 1996.
121. Hallberg L. Bioavailability of dietary iron in man. *Ann Rev Nutr*. 1981;1:123–147.
122. Monsen ER, Hallberg L, Layrisse M, et al. Estimation of available dietary iron. *Am J Clin Nutr*. 1978;31:134–141.
123. Tseng M, Chakraborty H, Robinson DT, Mendez M, Kohlmeier L. Adjustment of iron intake for dietary enhancers and inhibitors in population studies: Bioavailable iron in rural and urban residing Russian women and children. *J Nutr*. 1997;127:1456–1468.
124. Bothwell TH, Baynes RD, MacFarlane BJ, MacPhail AP. Nutritional iron requirements and food iron absorption. *J Intern Med*. 1989;226:357–365.
125. Berkow R, Fletcher A, Beers M. *The Merck Manual*. 16th ed. Rahway, NJ: Merck & Co; 1992.
126. US Department of the Navy. *Navy Military Personnel Manual*. Washington, DC: Headquarters, DN; 2002. Article 1220-100.

127. Lee AP, Yamamoto LG, Relles NL. Commercial airline travel decreases oxygen saturation in children. *Pediatr Emerg Care*. 2002;18:78–80.
128. Snow C. Laboratory diagnosis of vitamin B₁₂ and folate deficiency: A guide for the primary care physician. *Arch Intern Med*. 1999;159:1289–1298.
129. Herbold B, Frates S. Update of nutrition guidelines for the teen: Trends and concerns. *Curr Opin Pediatr*. 2000;12:303–309.
130. Campbell NR. How safe are folic acid supplements? *Arch Intern Med*. 1996;156:1638–1644.
131. Dharmarajan TS, Norkus EP. Approaches to vitamin B₁₂ deficiency: Early treatment may prevent devastating complications. *Postgrad Med*. 2001;110:99–105. Quiz 106.
132. Ozer E, Park M, Paul T, Brindis C, Irwin C. *America's Adolescents: Are They Healthy?* San Francisco, Calif: National Adolescent Health Information Center; University of California; 2003.

ATTACHMENT 1: COMPARISON OF WEIGHT-CONTROL PROGRAMS IN THE THREE MILITARY SERVICES

This attachment compares the screening standards for placing a service member in a weight-control program, the weight-control policies of each service, and the different intervention programs of each service. The US Department of Defense has set out the requirements for each of the services in developing their individual physical fitness and body fat programs.¹ The military services are required to ensure that physical fitness programs include a wellness concept and lifestyle enhancement elements to improve general health and fitness. The programs must include exercise guidance, dietary information or counseling, and assistance in behavior modification.

Screening standards for the US Army and US Navy are similar, but the Air Force uses different measurements. Both the Army and Navy measure body fat by using tape measurements at selected anatomical sites and predetermined charts. This method is inexpensive and can be used with little training.

US ARMY WEIGHT MANAGEMENT PROGRAM

Army Regulation 600-9, *The Army Weight Control Program*,² requires commanders and supervisors to administratively monitor all soldiers in their unit for maintenance of proper weight, body composition, and military appearance. At a minimum, personnel are weighed when they take the Army Physical Fitness Test (APFT) or at least every 6 months. Individuals who either exceed the screening weight or are identified by the commander for a special evaluation will have a body-fat evaluation. Routine weigh-ins are done at the unit level.

Screening and Enrollment Procedures

Unit commanders or supervisors monitor body-fat composition for all members (officers, warrant officers, and enlisted personnel) of their command whose body weight exceeds the screening weight or whose appearance suggests excessive body fat. The maximum allowable body-fat standards for the US Army after the recruit period (first 6 months) are shown in Table 22-3. The Department of Defense body-fat goal is 20% or less for all men and 30% or less for all women serving the military.

Soldiers who exceed body-fat standards are entered in the Army Weight Control Program (AWCP) by unit commanders and

- are suspended from favorable personnel actions;
- receive a medical evaluation by healthcare personnel;
- receive weight-reduction counseling and follow-up by healthcare personnel (if command-directed); and
- receive fitness instruction from a unit fitness trainer or designee.

Weigh to Stay

Army dietitians have developed an intensive standardized weight management and education program called “Weigh to Stay.” This program includes a three-part educational series with designated follow-up to provide soldiers with tools to learn and establish healthy eating and exercise habits. The program is standardized throughout the Army to ensure that all soldiers—active duty and reserve, regardless of duty station—receive the same high-quality nutrition education, therapy, and follow-up. Weigh to Stay is mandatory for all soldiers enrolled in AWCP.

The Weigh to Stay program includes three separate classes covering nutritional basics and myths, supplement use, menu planning, behavior modification, and exercise. Multidisciplinary teams consisting of dietitians, physical therapists, and psychologists teach the classes. Soldiers are given follow-up appointments at 30, 60, 90, and 180 days after their enrollment in the initial class.

Commanders and supervisors provide educational and other motivational programs to encourage personnel to attain and maintain proper weight and body-fat standards. Exercise programs are included, even though minimum APFT standards may be achieved.

The required weight-loss goal—3 to 8 pounds a month or a 1% reduction in body fat—is considered safely attainable and can enable soldiers to lose excess body fat and meet the body-fat standards. Unit personnel record

weigh-ins and body-fat measurements monthly (or during unit assemblies for Army National Guard and Army Reserve personnel). If a soldier does not make satisfactory progress between two consecutive monthly weigh-ins, the commander or supervisor will inform the individual in writing that he or she is subject to separation.

Monitoring Soldiers Who Have Been Removed from the Army Weight Control Program

Commanders continue to monitor soldiers for an additional 36 months after they have been removed from AWCP. If a soldier again exceeds body-fat standards within 12 months after leaving the program (and if no underlying or associated disease is found as a cause), the unit commander may initiate separation. Soldiers who exceed body-fat standards between 12 and 36 months after leaving the program (and no underlying or associated disease is found as a cause) will be allowed 90 days to meet standards or will be subject to separation.

NAVY FITNESS PROGRAM

All Navy personnel, regardless of age, participate in a semiannual Physical Fitness Assessment (PFA). The PFA includes a body composition assessment (BCA) and a physical readiness test (PRT). The BCA is the maximum weight-for-height screening and body-fat percentage estimation based on circumference measurements. The results of PFAs, which are required of active duty and reserve service members, have administrative consequences.³ (Although commanding officers may require additional PRTs or BCAs to monitor individual progress, only the official semiannual PFA has administrative consequences.)

Screening and Enrollment Procedures

Personnel are measured for height and weight normally within 10 days, but not less than 24 hours, prior to their participation in the PRT. The BCA is failed when members exceed both the maximum weight-for-height screening and the body-fat percentage allowed for member's age and gender (see Table 22-4).

Participation in ShipShape

Navy dietitians and specialists developed the Navy's ShipShape program, an action-oriented weight-management program designed to teach a healthier lifestyle and improve body composition. The 8-week program focuses on nutrition education, behavior modifications, and increasing exercise to support a healthier lifestyle. The program uses different types of educational videotapes and food models to teach proper portion sizes and demonstrates product label reading with grocery store items. The exercise portion of ShipShape promotes the health benefits of weight lifting and aerobic exercise, using a training circuit with alternating aerobic and strength-training exercises. The exercises include the use of medicine balls, push-ups, sit-ups, and jump ropes. Completion of the program, refusal to participate, or premature termination is documented in each participant's service record.

Physical Fitness Assessment Failures

The service member's command is responsible for tracking PFA results and taking appropriate administrative action. Members are notified in writing after each PFA failure. Written counseling must detail substandard performance requiring correction, action required of members, and administrative consequences for failure to correct performance. Members who fail three or more PFAs in the most recent 4-year period may face possible negative administrative actions. However, members are not processed for administrative separation solely for failure to meet PRT standards. Members are retained when retention is in the best interest of the Navy.

AIR FORCE FITNESS PROGRAM

In an effort to move from a fatness to a fitness culture, the Air Force revamped its weight and body fat management program and fitness program and implemented these changes Air Force-wide in January 2004. According to AFI 10-248, *Fitness Program*, "[t]he goal of the Fitness Program...is to motivate all members to participate in a year-round physical conditioning program that emphasizes total fitness, to include proper aerobic conditioning,

strength/flexibility training, and healthy eating.”^{4(p1)} The physical fitness assessment measures health and fitness via three evidence-based fitness components: (1) aerobic fitness, (2) body composition, and (3) muscular fitness. The fitness program and assessment create a nonpunitive health- and science-based approach to stimulate and educate Air Force members to establish and maintain a healthy lifestyle.

The new Air Force program differs from those of the Army and Navy. Height and weight measurements are taken but are not part of the fitness score. Body mass index is used to identify members whose body mass index is lower than 19 kg/m². Individuals falling into this low-weight category are referred to a healthcare provider for medical evaluation when first detected, because extremely low body weights have also been associated with diseases and disorders related to malnutrition.

Scores for aerobic fitness, body composition, push-ups, and crunches are added to determine fitness level. Service members must complete all components unless medically exempted. Component scores are weighted to comprise a composite score (0–100): 50 for the aerobic activity (1.5-mile run or bike test), 30 for body composition (measured by abdominal circumference), 10 for push-ups, and 10 for crunches. Determination of the score is based on age and gender of the service member. Composite scores place each member into 1 of 4 categories:

- | | |
|---------------------|---------------------------|
| 1. Excellent | Composite score ≥ 90 |
| 2. Good | Composite score 75–89.99 |
| 3. Marginal | Composite score 70–74.99 |
| 4. Poor | Composite score < 70 |

Service members who score marginally (70–74.99) must attend a healthy living workshop (HLW) and retest in 180 days. If they score poorly (< 70), they must participate in the fitness improvement program (FIP) and attend an HLW. If the service member scores poorly and has an abdominal circumference greater than 35 inches for women and greater than 40 inches for men, he or she must also participate in the body composition improvement program (BCIP) and retest in 90 days. If the service member continues to score marginally or poorly, he or she will retest every 180 or 90 days, respectively.

The HLW is a 2-hour class consisting of three educational components: (1) behavioral change techniques/goal setting, (2) fitness education, and (3) nutrition education. A multidisciplinary team consisting of a behavioral health specialist, an exercise physiologist or fitness program manager, and a dietitian/diet therapist teaches the class. The objectives are to increase confidence in setting and achieving goals, provide tools and strategies to make positive changes in fitness, and identify nutrition strategies to improve performance.

The FIP is taught by the exercise physiologist/fitness program manager. Participants receive exercise prescriptions and hands-on training before the monitored FIP, in which they exercise four to five times per week. Because abdominal fat cannot be eliminated through spot exercises, overall weight loss is required. The BCIP addresses weight loss and consists of two classes, which are taught by registered dietitians or diet therapists. The classes include a variety of healthy weight management instruction, exercises and homework focusing on development of an individualized plan of lifestyle modification, nutrition education and counseling, behavior modification, self-monitoring techniques, and weight-loss maintenance. At least monthly follow-up is mandatory for the FIP and BCIP until the service member scores higher than 70.

In 2002 the Air Force initiated an innovative and multiphased approach to prevent weight gain, called “Shape Your Future...Your Weigh!” (SYFYW) (see Attachment 3). SYFYW is one of many tools that the Air Force has in its arsenal to combat overweight and obesity. It complements and fills gaps within these efforts, without unnecessary redundancy or overlap. For example, SYFYW provides awareness of weight-creep, how to prevent weight gain, and identifying and addressing high-risk weight-gain situations over the span of a career. In addition, SYFYW provides environmental strategies to support and encourage healthful lifestyles. The fitness program provides a support structure, emphasizes disease prevention, encourages a fitness-oriented culture, and establishes standard fitness-assessment criteria. The HLW, FIP and BCIP provide specific counseling on diet and physical activity. All of these elements complement and support each other by adhering to the same principles; together they maximize total impact by approaching the obesity/overweight problem from different angles.

REFERENCES

1. US Department of Defense. *DoD Physical Fitness and Body Fat Programs Procedures*. Washington, DC: DoD; 2002. DoD Instruction 1308.3.

2. US Department of the Army. *The Army Weight Control Program*. Washington, DC: Headquarters, DA, US Army Publishing Agency; 1987. Army Regulation 600-9.
3. US Department of the Navy. *Physical Readiness Program*. Washington, DC: Headquarters, DN; 2002. OPNAV Instruction 6110.1G.
4. US Department of the Air Force. *Fitness Program*. Washington, DC: Headquarters, DAF; 2004. Air Force Instruction 10-248.

ATTACHMENT 2: ASSESSMENT OF SELECTED WEIGHT-LOSS DIETS

NUTRITIONALLY SOUND WEIGHT-LOSS DIETS

Scrutiny of weight-loss diet plans reveals that some are nutritionally sound, and others are not. When weight loss is the goal, dieters must be sure that their nutritional needs are met and that their health does not suffer from dietary restrictions.

Different foods and food plans appeal to different individuals trying to lose weight. Some key characteristics that help identify an effective program include the following:

- **Physical activity.** Weight loss is difficult to maintain without exercise. Americans—even those on active duty in the military—are more sedentary now than they were 10 years ago. Exercise is the best way to speed up metabolism or keep it from slowing down with aging.
- **Support.** Although some people can read a handout, take the advice, and lose weight, most need some sort of support. This can be in the form of a group, one-on-one counseling, a friend, or frequent e-mail messages or telephone calls from a dietitian or health professional. Dieters need reassurance that what they are doing is effective and healthy.
- **Long-term follow-up.** Some type of long-term follow-up will keep the dieter on track or get him or her back on track.
- **Lifestyle skills.** These skills include cooking healthy; selecting low-fat foods at the grocery store; portioning servings appropriately; eating a low-fat, low-calorie meal while dining out; and including the family in the dieter's lifestyle changes.

The Life Choice Diet

Dr Dean Ornish's Life Choice diet focuses on making lifestyle changes that include diet, stress management training, emotional support, smoking cessation, and moderate exercise. Although the diet's initial goal was to prevent and reverse heart disease, Ornish discovered that the program also resulted in weight loss. In his book *Eat More, Weigh Less*,¹ Ornish describes how participants eat more food but take in fewer calories by making healthier food choices. He claims that diets that restrict food intake and calories lower metabolism, whereas Life Choice increases food intake without increasing calories, which maintains or increases metabolism. He recommends that people monitor their hunger and eat when hungry and stop when full, not when stuffed.

In the Life Choice diet, fat makes up only 10% of the daily calories. For the average dieter, this amounts to 20 to 25 g fat per day. The diet is essentially a very low-fat vegetarian diet with some yoga. Dining in restaurants or a military dining facility may be difficult under this eating plan.

Weight Watchers, Jenny Craig, and NutriSystem Diets

All three programs are low-fat, calorie-reduction diets. Participants pay a membership fee and purchase their foods in some of the programs, which are basically low-fat, low-calorie, portion-controlled frozen dinners. Some individuals are successful on these programs, but long-term maintenance may be difficult because of the high cost of foods and services. These programs may not be financially reasonable for service members in lower pay grades.

Atkins, Zone, No Carb, Healthy for Life, Protein Power, and Sugar Busters! Diets

These six diets were popular in the 1970s, fell out of favor, and then regained popularity in the mid-to-late 1990s. Some of the diets that fall into the low-carbohydrate category could be considered borderline faddish. However, some of the less extreme low-carbohydrate diets make good nutritional sense and can be easily worked into a healthy weight-loss program.

The Claims

The common thread with all these popular diets is that they are low in carbohydrates and high in protein, fat, or both. Some authors of the diets claim that carbohydrates cause insulin resistance, leading to obesity. They also claim that carbohydrates are addictive and eating carbohydrates stimulates the appetite. Conversely, some authors claim that eating fatty foods makes the body burn fat better. These diets claim to lead to rapid weight loss and improved cholesterol levels.

The Realities

Despite popular belief, carbohydrates are not more fattening than fat nor is fat more fattening than carbohydrates. Insulin levels do increase when carbohydrates are consumed because insulin is needed to digest carbohydrate; however, insulin resistance is caused by inactivity and obesity, not by carbohydrates. Rapid weight loss is from low calorie intake and dehydration. Improvements to cholesterol levels are likely the result of weight loss. High-protein and high-fat foods are filling, causing people to eat less. Carbohydrates don't stimulate the appetite, nor are they addictive. (People do crave carbohydrates, but cravings are not the same as an addiction. Cravings are based on emotions, and many individuals associate certain carbohydrates with being comforted.)

Potential Health Problems

Many health problems can be caused by intrinsically unhealthy diets. Among the most frequent negative consequences to health are the following:

- increased total and low-density lipoprotein (bad) cholesterol and decreased high-density lipoprotein (good) cholesterol, because of long-term high saturated fat intake;
- kidney damage or kidney stones, caused by high protein intake, decreased produce intake, decreased body water, and increased blood uric levels;
- calcium excretion caused by too much protein, resulting in osteoporosis;
- fatigue caused by the loss of lean muscle mass, dehydration, and inadequate carbohydrates; and
- irritability, distraction, lowered mental alertness, apathy, and depression, all caused by inadequate carbohydrates, low glycogen stores, and inadequate vitamin B complex.

Can the Diets Be Fixed?

Overweight Americans should eat fewer carbohydrates but not cut them out altogether. During the low-fat craze of the 1980s and 1990s, many Americans ate as many carbohydrates as they wanted, as long as the food was fat-free, and were then disappointed that their weight did not drop. Low-carbohydrate diets have been around since the 1970s. If they really worked, we would not be getting fatter. The important point to remember is that weight gain is not caused by any particular macronutrient but from eating too many calories and inadequate exercise.

Slim-Fast and Nestlé Sweet Success Diets

"Drink a delicious shake for breakfast and lunch, have a shake or nutrition bar for a snack, then have a sensible dinner."

How the Diets Work

Dieters reduce daily calories by drinking a 200- to 250-kcal milkshake instead of eating a meal. This can result in a significant calorie cut, especially if the individual usually consumes high-calorie foods for these meals. The diet recommends that dinner be held to approximately 600 kcal, making daily total intake less than 1,500 kcal.

Can the Diets Be Fixed?

The shakes are fortified with nutrients, including calcium, iron, magnesium, folic acid, vitamin C, vitamin A, and vitamin B₆. As long as the dieter eats a balanced dinner and has 2 or 3 pieces of fruit a day, instead of another shake for a snack, he or she may lose weight without compromising nutritional status.

LESS-SOUND WEIGHT-LOSS DIETS**One-Week Cabbage Soup Diet**

Dieters eat a soup made of cabbage, onions, peppers, tomatoes, and celery. They may eat as much of the soup as they want, plus a specified food for each day of the week, and must also drink four glasses of calorie-free beverage daily. Dieters must also either take a herbal appetite suppressant mid-morning and mid-afternoon or drink beverages with caffeine. This diet promises that the dieter will lose 17 lbs in 1 week. After 7 days of this diet, the dieter is instructed to follow a healthy diet plan to keep the weight off.

How the Diet Works

People lose weight because they lose water and muscle mass while eating an average of 1,000 kcal per day for a week. Soup is filling and therefore acts as an appetite suppressant. This particular soup is very low calorie. There is nothing magical about cabbage. Some dieters may experience gas, nausea, and fatigue after 2 or 3 days on this diet. Three consecutive days without significant protein followed by 3 days of a high protein load will make the dieter feel tired and ill. This diet is severely deficient in protein, calcium, zinc, iron, vitamin B₁₂, vitamin D, and other nutrients.

Can the Diet Be Fixed?

Any dietitian would recommend eating more fruit and vegetables. Switching to skim milk and sugar-free beverages will help any dieter lose weight. Contrary to the claim made for cabbage soup, there is *no* food that we should eat as much of as we want.

Grapefruit Diet (or the Hollywood Diet)

This diet claims that grapefruits contain a special fat-burning enzyme and that eating grapefruit before every meal will promote weight loss. The rest of the diet is composed of coffee, minimal bread, no meat, and minimal fruit and vegetables.

How the Diet Works

There is nothing special about grapefruit. The dieter is simply eating fewer than 800 kcal per day.

Can the Diet Be Fixed?

This diet is deficient in calcium, vitamins B₁₂ and D, iron, protein, and more.

Clear Liquids Diet

For up to 1 week, the dieter consumes nothing but fruit juice, clear broth, tea, or water. This diet cannot be fixed. Although clear liquids do contain some calories, this diet does not provide appropriate nutrition.

Blood Type Diet

This diet claims that, based on one's blood type, certain foods should be either eaten or avoided for the dieter to lose weight and stay healthy. There is no scientific evidence to back up this diet. Any weight loss is

from eating less food or taste fatigue, making long-term use of this diet highly unlikely. Some blood types eat no dairy, others no meat. The potential nutrient deficiencies (eg, calcium, vitamin B₁₂) are clearly evident. This diet cannot be fixed.

Pills and Other Dietary Supplements

Prescription weight-loss medications are not currently authorized for use by active duty military. Hundreds of weight loss supplements are available at health food stores and Web sites. Most supplements contain potentially harmful ingredients, and none have been proven to cause permanent and safe weight loss. The US Food and Drug Administration regulates few supplements.

There is no safe, effective dietary supplement for weight loss. Most dieters intend for weight loss to be long term. If a pill were safe and available to help someone lose weight, what would happen when the dieter stops taking the pill? The safety of any weight-loss medication is not yet confirmed.

REFERENCE

1. Ornish D. *Eat More, Weigh Less*. New York, NY: HarperCollins Publishers, Inc; 1994.

ATTACHMENT 3:
A US AIR FORCE HEALTH-PROMOTION MODEL: “SHAPE YOUR FUTURE...YOUR WEIGH!”
THE “SHAPE YOUR FUTURE” PROGRAM

In October 2002 the US Air Force deployed its weight-gain prevention program, “Shape Your Future...Your Weigh!” (SYFYW). The development of the program was influenced by two well-established principles of marketing:

1. interpersonal communication, social networks, and environmental cues are supported by comprehensive social marketing efforts;¹ and
2. environmental reinforcements assist marketing tactics to “naturally reinforce” the desired change in behavior.²

The program is designed to benefit new accessions and recruits, as well as all other members and beneficiaries of the Air Force, by helping to create and maintain a prevention-oriented culture that emphasizes the importance of maintaining a healthy weight through behaviors related to nutrition and exercise.

SYFYW evolved to fill a programmatic void in weight-gain prevention and lack of awareness of the impact of weight creep. Using criteria from the National Institutes of Health, approximately 46% of the active duty US Air Force are currently overweight and 8% are obese.³ The average Air Force member experiences a weight creep of 1.5 to 2 pounds per year.⁴ Despite these statistics, 72% of Air Force health-promotion managers reported that their installations did not have a base-wide, weight-gain prevention initiative because of lack of time (30%), lack of manpower (33%), or lack of interest from leadership (11%). Yet, more than 50% reported that prevention of weight gain is an important issue that needs to be addressed.

Thus, a multilevel, population-based initiative was developed to target overweight and inactivity among 555,200 active duty and reserve personnel stationed at Air Force installations worldwide. Packaged and deployed as an electronic tool kit, SYFYW combines social marketing and health communications with environmental strategies that commanders can use to create a supportive atmosphere for fitness and good nutrition. SYFYW has the ability to reach large audiences with a consistent message to enhance weight and fitness-related programs and initiatives throughout the Air Force. Social marketing campaigns, such as phase 1 of SYFYW, “represent only one force among many driving and restraining forces.”^{5(p179)}

The SYFYW development team began in June 2001. More than 35 health professionals from a variety of disciplines—including registered dietitians, exercise physiologists, nurses, health psychologists, health educators, diet technicians, physicians, and physician assistants—work on the project. Many members of the team hold positions in Air Force health and wellness centers. The intent of SYFYW is to implement progressive phases, each targeting different populations and aspects of military life that may impact weight gain and its prevention. SYFYW is divided into three phases. The mission of the program is to expand the awareness of weight creep, provide multiple strategies to prevent or limit weight gain, empower individuals to achieve and maintain a healthy lifestyle, and energize a community approach to preventing weight gain.

Phase 1

Phase 1, intended for easy implementation, targets active duty personnel and empowers health-promotion personnel to brief senior leaders, medical personnel, and other service members on what they can do to prevent weight gain. Complementary mass media components include posters, briefings, newspaper articles, e-mail messages, and handouts to propel the social marketing campaign.

Before the release of phase 1 in October 2002, a 6-month pilot test was conducted at five Air Force bases. Feedback from the pilot test bases was overwhelmingly positive, and suggestions were incorporated into the final package. Progress toward voluntary implementation of phase 1 at all Air Force bases began in 2004. Within the first 6 months of release, 41% of health-promotion managers had begun implementation at their bases; within the first year, the number had increased to 55%. Common reasons cited for implementation were importance to the base population, availability of materials, and ease of implementation with a readily deployable product.

Phase 2

This phase includes the environmental road map (ER), an evaluation tool that commanders can use as a local barometer to measure and improve the fitness culture and environment on their installations. The ER targets modifications that can be made in

- the built environment (eg, man-made structures, such as sidewalks, fitness trails);
- worksite (eg, the availability and price structure of healthy foods, the promotion of physical activity);
- base-wide fitness and nutrition programming;
- training throughout the military lifecycle; and
- addressing weight gain during healthcare visits.

The central Air Force Health Promotion office will track changes made as a result of the ER initiative.

Phase 2 also includes a community Web site (<https://www.afms.mil/shapeyourfuture>) that delivers accurate, practical nutrition and fitness information to commanders, unit fitness monitors, and active duty and reserve personnel. This publicly accessible electronic tool kit is showcased as a link on the US Air Force portal and numerous other Web sites to reach a potential audience of 2.4 million beneficiaries.

The tool kit provides self-assessment tools, quick tips, articles, handouts, links to other sites, and other resources related to weight management, fitness, nutrition, and behavior. The community site was released in August 2004.

Phase 3

Phase 3 will address high-risk situations in the Air Force member life cycle, such as deployments, injuries, and prolonged stress, which may promote weight gain. Resources for the active duty family (eg, prevention of pediatric obesity) will be expanded within the consumer site.

SUMMARY

Because so many competing forces try to influence an individual's health choices, a combination of social marketing, health communications, resources, and environmental and policy changes have been mobilized to create the Air Force's SYFYW program.

The SYFYW initiative features a tool kit of valuable resources to heighten awareness and provide solutions for behavior change, with the ultimate goal of reversing weight-gain trends among Air Force members and beneficiaries. SYFYW is designed to perform the following:

- highlight and create awareness of the impact of weight creep,
- provide simple methods and resources to reduce weight creep,
- create a demand for health services, and
- reinforce maintenance of a healthy weight and associated positive behaviors.

The tool kit uses various strategies and resources to assist people as they move through all the stages of change of the weight continuum focusing on prevention of weight gain.

REFERENCES

1. Winett LB, Wallack L. Advancing public health goals through the mass media. *J Health Commun.* 1996;1:173–196.
2. Elder JP, Geller ES, Hovell MF, Mayer JA. Intervention. IV: Social marketing and health communication. In: *Motivating Health Behavior*. New York, NY: Delmar Publishers, Inc; 1994: Chap 10.
3. Robbins AS, Chao SY, Fonseca VP, Snedecor MR, Knapik JJ. Predictors of low physical fitness in a cohort of active-duty U.S. Air Force members. *Am J Prev Med.* 2001;20:90–96.

4. Robbins AS, et al. Unpublished data, March 2001.
5. Salmon, 1989 (pp 44–45). Cited by: Winett LB, Wallack L. Advancing public health goals through the mass media. *J Health Commun.* 1996;1:173–196.

