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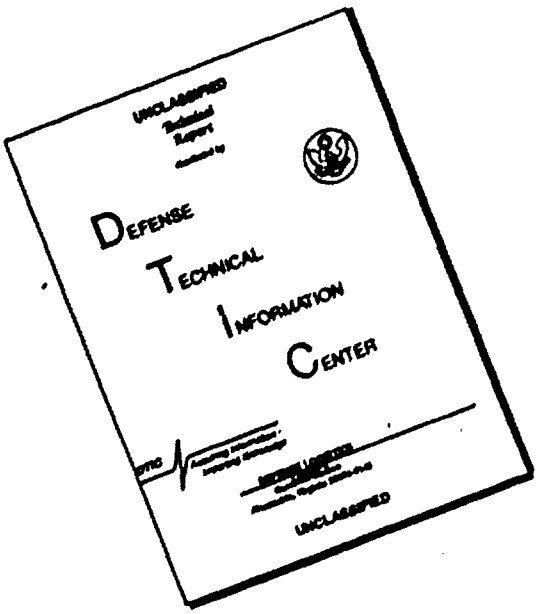

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Military Nutrition Initiatives

Committee on Military Nutrition Research

Food and Nutrition Board

Institute of Medicine

Washington, D.C.

Military Nutrition Initiatives

A Brief Report Submitted by

The Committee on Military Nutrition Research

Food and Nutrition Board

Institute of Medicine

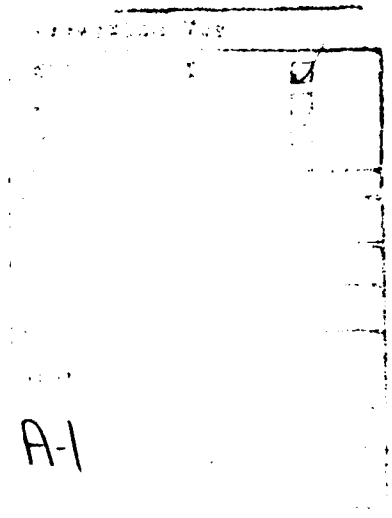
to

Major General Richard T. Travis

Commanding General

U.S. Army Medical Research and Development Command

February 25, 1991



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NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competencies and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering and the Institute of Medicine.

The Institute of Medicine was chartered in 1970 by the National Academy of Sciences to enlist distinguished members of the appropriate professions in the examination of policy matters pertaining to the health of the public. In this, the Institute acts under both the Academy's 1863 congressional charter responsibility to be an advisor to the federal government and its own initiative in identifying issues of medical care, research, and eduction. Dr. Samuel O. Thier is President of the Institute of Medicine.

Publication IOM-91-05

Military Nutrition Initiatives

Introduction and Background

The Military Nutrition Division of the U.S. Army Research Institute of Environmental Medicine (USARIEM) asked the Committee on Military Nutrition Research (CMNR) to review the significant reports recently published dealing with Nutrition and Health and to consider how their recommendations pertain to the nutritional policies and practices of the military. During parts of two meetings of the CMNR on December 8, 1989 and June 28-29, 1990 the recommendations of: the Diet and Health Report of the Food and Nutrition Board (1), the Surgeon General's Report on Diet and Health (2), and the Year 2000 Health Objectives for the Nation (3) were reviewed by representatives of these agencies. The CMNR was also briefed on the results of dietary surveys conducted over the past few years at several military installations. In addition, a presentation of some of the activities in the promotion of sound nutrition and health programs for Army personnel was provided for the information of the Committee. The Committee was unable to complete its discussion and evaluation at the December 8, 1989 meeting and the review was completed at the June 28-29, 1990 meeting. In the Appendices to this report are the agendas, references, briefing materials, presentation graphics and excerpts from the minutes of these two meetings.

The Committee believes that the most definitive dietary recommendations are provided in the report of the NAS/NRC Committee on Diet and Health (1). The nine specific recommendations of this report are as follows [Excerpted from The Executive Summary of Diet and Health (1), pp 10-15.] :

1. Reduce total fat intake to 30 percent or less of calories. Reduce saturated fatty acid intake to less than 10 percent of calories, and the intake of cholesterol to less than 300 milligrams daily.

2. Every day eat 5 or more one-half cup servings of a combination of vegetables and fruits, especially green and yellow vegetables and citrus fruits. Also, increase intake of starches and other complex carbohydrates by eating 6 or more daily servings of a combination of breads, cereals, and legumes. Carbohydrates should total more than 55 percent of calories.

3. Maintain protein intake at moderate levels -- that is, approximately the current Recommended Dietary Allowance (RDA) for protein, but not exceeding twice that amount or 1.6 grams/kilogram of body weight for adults.

4. Balance food intake and physical activity to maintain appropriate body weight.

5. The Committee does not recommend alcohol consumption. For those who drink alcoholic beverages, the Committee recommends limiting consumption to the equivalent of less than 1 ounce of pure alcohol in a single day. This is equivalent to 2 cans of beer, 2 small glasses of wine, or 2 average cocktails. Pregnant women should avoid alcoholic beverages.

6. Limit total daily intake of salt to 6 grams or less. Limit the use of salt in cooking and avoid adding it to food at the table. Salty, highly processed salty, salt-preserved, and salt-pickled foods should be consumed sparingly.

7. Maintain adequate calcium intake.

8. Avoid taking dietary supplements in excess of the Recommended Dietary Allowances in any one day.

9. Maintain an optimal intake of fluoride, particularly during the years of primary and secondary tooth formation and growth.

Committee Recommendations

The CMNR reviewed the nine dietary recommendations of the NRC Committee on Diet and Health as they pertain to the nutritional policies and practices of the military. In general, the Committee endorsed the recommendations as being applicable to the military with the exception of the recommended level of sodium intake, that was considered to be too low for military requirements. The Committee made the following specific comments concerning the implementation of the Diet and Health recommendations by the military.

1. The CMNR recommends that the goal for military personnel should be to reduce their total fat intake to 30 percent or less of total calories, to reduce saturated fatty acid intake to less than 10 percent of calories, and cholesterol intake to less than 300 mg/day. This goal is appropriate for garrison feeding. To

accomplish this, there should be a program of continued education of military personnel and their families as to appropriate food choices and an evaluation of possible menu changes and/or portion sizes in the military food service program. It was agreed, however, that a full range of food choices should be maintained in garrison settings and that the primary emphasis should be on educational programs to modify diet rather than limiting availability of specific high fat food items. The Committee acknowledges that it is not realistic to expect the military to reach this goal at a rate much faster than the civilian population of similar demographic characteristics, since military personnel in garrison have similar options for food selection either through choosing to eat in military dining facilities, at home, or in readily available food service options in the community. The Committee recommends that the emphasis should be on alternative food selections available in the mess halls to allow individuals to meet this goal, for example, in addition to low fat and whole milk, skim milk could regularly be available as well as regular and low fat salad dressings. In garrison food preparation, meats should be trimmed and gravies and sauces prepared with inclusion of low-fat products wherever possible.

The Committee was pleased to note that actions taken by the military over the past several years through nutrition education programs and policy changes, apparently are showing considerable progress toward achieving the goal of reducing total fat intake. This is illustrated by comparison of studies conducted prior to initiating the nutrition education program that showed a range of 41.8 to 48.6% of calories consumed from fat with a study that showed a range of 38.4 down to 34.0% of calories from fat in 1988 after the education program had been implemented. These data indicate progress in reduction of dietary fat intake that is not appreciably different from comparisons with the U.S. civilian population. (See the summary chart on page 7.) While the methods used to collect the data presented in this table are not directly comparable, the trends illustrated in the military studies are similar to that shown for the U.S. civilian population.

Presumably, this reduction in fat was replaced primarily by carbohydrate food sources. The Committee does not feel that it is necessary to further alter menus or recipes to reduce the dietary fat content, particularly where acceptance of the food item is compromised. Instead, extensive nutrition education should be continued so the soldier can make informed food choices leading to a higher proportion of energy from carbohydrate. Educational programs should include specific suggestions regarding healthy snack choices. These programs need to incorporate the availability of alternative snacks such as fresh fruit, low fat yogurt, low fat and low salt snack items in vending machines.

The recommendation concerning limiting cholesterol intake to not more than 300 milligrams per day presents the greatest challenge to military nutrition programs due

to the preference for eggs in the breakfast menu in garrison feeding. The Committee recommends the continued inclusion of eggs in the menu, but emphasizes that low cholesterol breakfast alternatives should be available and attractively presented.

2. The Committee on Diet and Health recommended a daily intake of 5 or more one-half cup servings of a combination of vegetables and fruits, especially green and yellow vegetables and citrus fruits. Concern was expressed that this goal may be difficult to achieve without some changes in monetary ration allowances to permit the purchase and storage of larger quantities of fresh vegetables and fruits. However, it should be clear that frozen or canned vegetables and fruits are an acceptable alternative in meeting this objective.

An intake of 6 or more daily servings of a combination of breads, cereals and legumes was recommended by the Committee on Diet and Health. Carbohydrates should provide a total of 55% or more of total calories. To meet this goal consideration should be given to the expansion of the number of starch selections, such as bean and pasta entrees, available at each meal, as well as offering several different bread choices.

3. As the proportion of energy derived from carbohydrate increases, the percent calories from protein will decline. This is in line with the Diet and Health recommendation that protein intake be maintained at a moderate level, i.e. approximately 0.8 g/kg body weight and not to exceed 1.6 g/kg body weight. For a 70 kg man this translates to an intake of 56 to 112 grams of protein per day. This level of dietary protein is sufficient to support good physical performance and also to allow an increase in lean tissue with training. Dietary carbohydrates are readily used for fuel during physical activity; a high carbohydrate diet supports good physical fitness.

4. Total caloric intake should be adjusted to achieve and maintain military body weight and body composition standards. Specific goals and recommendations may be developed as a result of a CMNR workshop on body composition that took place in February, 1990. (The report based on this workshop is currently in preparation.)

5. The CMNR considered the Committee on Diet and Health recommendation of 6 grams or less of salt intake per day for the general population to be too low for military purposes. This is due to the potential risk of producing sodium depletion under some conditions, particularly exposure to a hot environment without an adequate period of adaptation. The Committee therefore recommends that the total daily intake of salt should be limited to 10 grams or less, except under conditions in which salt requirements exceed these values due to large salt losses

such as those associated with heavy physical work in hot environments. Appropriate limitation on the use of salt in menu preparations consistent with adequate food acceptance and avoiding additions to food at the table should permit the achievement of this goal.

6. Dietary calcium is necessary for adequate growth and skeletal development. Recent research shows that bone growth continues through the third decade of life. Women, because of their low caloric intakes and increased risk of osteoporosis, especially need to make careful food choices to obtain an adequate calcium supply. The Committee recommends the following:

a) a nutrition education program be established for military women that emphasizes the importance of dietary calcium, and how to select calcium-rich foods; and

b) the provision of low-fat, calcium-rich food choices in the mess halls. Some of the following alternatives to whole milk might be considered for garrison feeding programs: dark green vegetables, low-fat frozen yogurt, and low-fat cheeses.

7. The CMNR endorses the recommendations of the Committee on Diet and Health regarding use of alcoholic beverages, dietary supplements, and optimal intake of fluoride, as appropriate for the military.

8. The nutrition recommendations from the Surgeon General's Report on Nutrition and Health are compatible with the Committee on Diet and Health 1989 recommendations discussed above.

9. The Committee has reviewed the Year 2000 Health Objectives for the Nation. The Committee finds no significant inconsistencies with the above recommendations and the nutrition objectives contained therein.

The Committee on Military Nutrition Research is pleased to note the interest of the military in promoting good nutrition, in improving the nutritional quality of military rations, and in efforts in nutrition education to help soldiers select diets consistent with current knowledge relative to healthy eating practices.

References

1. NRC (National Research Council). 1989. Diet and Health, Implications for Reducing Chronic Disease Risk. A report of the Committee on Diet and Health, Food and Nutrition Board, Commission on Life Sciences. National Academy Press, Washington, D.C. 749 pp.

2. DHHS (U.S. Department of Health and Human Services).1988. The Surgeon General's Report on Nutrition and Health. U.S. Government Printing Office, Washington, D.C. 727 pp.

3. DHHS (U.S. Department of Health and Human Services). Promoting Health/Preventing Disease: Year 2000 Objectives for the Nation. Draft for public review and comment, September, 1989. U.S. Government Printing Office, Washington, D.C.

Trends in Total Fat Intakes in Military Dining Facilities

PRE-INITIATIVES		% Fat Cals	POST-INITIATIVES		% Fat Cals
1952	FT SHERIDAN	46.0	1986	FT RILEY	37.6
1953	FT RILEY	48.6	1986	FT LEWIS	38.4
1966	FT HUACHUCA	45.5	1987	FT DEVENS	38.2
1971	LOWRY AFB	42.5	1988	FT JACKSON	
1976	US ARMY MIL ACAD	41.8		Males	34
1977	USS SARATOGA	42.1		Females	34

Comparison to USA Civilian Population

1977-78 USDA NFCS			1985-86 USDA CFS II		
	Males 20-29 yrs	41		Males 20-29 yrs	36
	Females 20-29 yrs	40		Females 20-29 yrs	36
1976-80 NHANES II					
	Males 20-29 yrs	36			
	Females 20-29 yrs	36			

FIGURE 6. from the set of presentation graphics for: "Current U.S. Army Dietary Intakes of Fat, Cholesterol and Sodium" as presented to the Committee on Military Nutrition Research by LTC E. Wayne Askew, Ph.D., December 8, 1989.

APPENDICES

Appendix I. Roster: Committee on Military Nutrition Research

Appendix II. Agenda, Background Material, Handouts, and Presentation Graphics pertaining to Military Nutrition Initiatives from the Committee on Military Nutrition Research meeting held December 8, 1989

Appendix III. Agenda, Background Material and Presentation Graphics pertaining to Military Nutrition Initiatives from the Committee on Military Nutrition Research meeting held June 28-29, 1990.

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Current Roster
Committee on Military Nutrition Research (CMNR)

COMMITTEE ON MILITARY NUTRITION RESEARCH

Robert O. Nesheim, Ph.D.
(Chairman)
President
Advanced Healthcare, Inc.
Monterey, CA

Richard Atkinson, M.D.
Professor of Internal Medicine
VA Medical Center
Hampton, VA

Andre Bensadoun, Ph.D.
Professor of Nutritional Biochemistry
Division of Nutrition Science
Cornell University

William Evans, Ph.D.
Chief, Human Physiology
USDA, Human Nutri. Center on Aging
Tufts University

Joel Grinker, Ph.D.
Program and Human Nutrition
School of Public Health
University of Michigan

Edward Horton, M.D.
Professor and Chairman, Medicine
Un. of Vermont, Coll. of Medicine

Richard Jansen, Ph.D.
Professor and Head, Dept of
Food Science and Human Nutrition
Colorado State University

Gilbert Leveille, Ph.D.
Staff Vice President, Science
Nabisco Brands Incorporated

John A. Milner, Ph.D.
Department of Nutrition
Penn State University

John Vanderveen, Ph.D.
Director, Division of Nutrition
Food and Drug Administration

ARMY Liaison:
COL E. Wayne Askew, Ph.D.
U.S. Army Research Institute
of Environmental Medicine
Natick, MA

FNB Staff:
Bernadette M. Marriott, Ph.D.
Program Director
Pamela Turner
Acting Senior Secretary

2/15/91

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Committee on Military Nutrition Research
Meeting December 8, 1989

IIa - Agenda, Meeting Description and List of Participants

IIb - Graphics from the Presentation: Implementation and Evaluation of Nutrition Initiatives in the Military.
Col. David D. Schnakenberg

IIc - Preliminary Results of Nutritional Surveys in United States Army Camps. Amer. J. Pub Hlth, 1919: vol 9 (6), 401-413.

IId - Executive Summary: Diet and Health, National Academy Press, 1989

IIe - Summary and Recommendations: The Surgeon General's Report on NUTRITION AND HEALTH, 1988

IIf - Background material from the Presentation: Surgeon General's Report, Setting Nutrional Goals.
1 - Summary: The Year 2000 National Overview
2 - Health Objectives Summary
Elena Carbone Britt

IIg - Background material from the Presentation: Implementation Strategies at a National Level
1 - New FNB Study on Implementing Dietary Guidelines
2 - Committee Membership
L. Moragne

IIh - Graphics/Handout from the Presentation: "Where We're At": The U.S. Army Nutrition Objectives
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LTC J. Turcotte

IIi - Background material from the Presentation: Military Nutrition
1 - Information Paper: Nutrition Initiatives
Col. M. Cronin

IIj - Background material and graphics from the Presentation:
Current U.S. Army Dietary Intakes of Fat, Chlesterol and Sodium
1 - Nutritional Evaluation of Military Feeding Systems and Military Populations (Overview)
2 - Presentation Graphics
LTC E. Wayne Askew

APPENDIX IIa.

Agenda, List of Participants, and Meeting Summary

AGENDA

COMMITTEE ON MILITARY NUTRITION RESEARCH

December 8, 1989

NAS Georgetown Campus
2001 Wisconsin Ave., N.W., Washington, DC 20007
Green Building, Conference room 120
(202) 334-3920

8:00-8:30	Continental Breakfast
8:30-8:45	Welcome Review of agenda Charge to the Committee: Focus on Military Nutrition Issues **.....Dr. Robert Nesheim**
8:45-9:15	Diet and Health Report Our national nutrition goals **.....Dr. Sushma Palmer**
9:15-9:45	Surgeon General's Report Setting national nutrition goals **.....Ms. Elena Carbone Britt**
9:45-10:05	Implementation Strategies at a National Level **.....Dr. Lenora Moragne**
10:05-10:35	"Where We're At" The U.S. Army Health Risk Appraisal U.S. Army nutrition objectives **.....Lt. Col. Turcotte** **.....LTC (P) Cook**
10:35-10:45	**BREAK**
10:45-11:15	The Scope of the problem The Incidence of diet related disease in the Army. Why this information is difficult to obtain **.....Lt. Col. Turcotte**

11:15-11:45	Current U.S. Army Dietary Intakes of fat, cholesterol, and sodium **.....Lt. Col. Wayne Askew**
11:45-12:15	Summary - Alignment of U.S. Army and national nutrition goals and objectives **.....Col. David Schnakenberg**
12:15-1:15	**LUNCH**
1:15-2:15	Discussion of this morning's presentations
2:15-2:30	**BREAK**
2:30-4:00	Executive Session Evaluation of "Where the Army is at" Committee recommendations **.....Dr. Robert Nesheim** Update on Committee activities - Proceedings of Workshop - Annual Report - Plans for February Workshop **.....Dr. Susan Berkow**
4:00	**ADJOURNMENT**

Committee on Military Nutrition Research
December 8, 1989

Members	Staff
Robert Nesheim, Chairman	Susan Berkow
Richard Atkinson	Lenora Moragne
William Evans	Fran Peter
Richard Jansen	Carole Suitor
John Vanderveen	
Edward Horton	
John Kinsella	
Andre Bensadoun	

Guests

LTC Wayne Askew	Dr. Sushma Palmer
Ms. Elena Carbone Britt	COL David Schnakenberg
LTC (P) Annetta Cooke	CPT Cecilia Thomas
COL Martha Cronin	LTC Judith Turcotte
Ms. Mary Alice Moring	Ms. Celia Adolphi

Summary of December 8, 1989 Meeting
Committee on Military Nutrition Research

The committee chairman opened the meeting and stated that the primary purpose of this meeting was to review the issues and recommendations from the extensive diet and health related reports, namely the Diet and Health Report of the National Academy of Sciences, the Surgeon General's report on Diet and Health and the Year 2000 Health Objectives for the Nation and to consider their relevance to the military environment. The committee was charged to consider the relevance of the issues raised in the preceding reports, to evaluate the relevance of these health initiatives to the military, to review the current health promotion activities carried out in the military, and to suggest priorities for the military in improving its health promotion activities among service personnel and their families.

The agenda (this appendix) lists the topics and speakers that reviewed the pertinent information for the committee. The original agenda was modified to have Col. David Schnakenberg's presentation lead off the program to provide the attendees

with background information concerning the evaluation and implementation of nutrition initiatives in the military (see Appendix B). He noted that some of the nutrition responsibilities of the Army Surgeon General are: to establish nutrition policy, and to set the Military Recommended Dietary Allowances (MRDA's), that are based largely on the RDA's established by the NAS but applied for military garrison feeding systems and for operational rations. In addition to the nutrient specifications, recommendations were considered for level of fat, calories, sodium and cholesterol. The current MRDA's were published in 1985 and the Military Nutrition Research Committee had participated in their review. Calories for garrison rations were to comprise not more than 35% of total calories, but may be as high as 40% in combat rations. The goal for sodium was not to exceed 1700 mg/1000 kcal. No recommendation was made for cholesterol. The Committee on Military Nutrition Research (CMNR) did not consider a recommendation in its review in 1984 as this issue was under consideration by another committee of the NAS. The MRDA's are used by DoD food service personnel in establishing policy, for recipe and menu development, nutrition education and health promotion, diet and assessment of military populations among others.

The Army has implemented nutrition initiatives for garrison feeding such as serving low-fat milk, modifying menus and educating cooks and soldiers to reduce fat to not more than 35% of calories. The Army has also conducted dining hall studies to evaluate progress in meeting the nutrition objectives.[1]

Dr. Sushma Palmer presented the findings of the Diet and Health Study, just released in August from the Food and Nutrition Board. She indicated that the Diet and Health Report contains a substantial analysis of the relationship between diet and chronic diseases. The scope of the work included criteria for evaluating evidence and formulating dietary recommendations. She noted that the evidence for linking diet and chronic disease was carefully reviewed, as was potential competing risks.

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1 After the meeting Col. Schnakenberg forwarded an interesting article for the attention of the committee: Preliminary results of nutritional surveys in United States army camps. Amer. J. Public Health, vol. 9 (6), 401-413, 1916. (Included in Appendix C). Col. Schnakenberg noted that he had inadvertently omitted this World War I data in his presentation of trends in fat intake in the military. He pointed out that in Table II of this article fat caloric intakes were listed as 29%. In addition, he wanted the committee to note that these 1919 recommendations were 12 1/2% of calories from protein, 25% from fat and 62 1/2% from carbohydrates. Col. Schnakenberg commented, "Not greatly different from Diet and Health recommendations 70 years later".

Some of the chronic diseases that are influenced by diet include atherosclerotic cardiovascular disease, hypertension, certain types of cancer, dental caries, chronic liver disease, obesity and non-insulin-dependent-diabetes. Dr. Palmer noted that most chronic diseases that are influenced by dietary factors are also influenced by genetic factors and concluded by providing the following summary of some of the Diet and Health Committee's recommendations:

- reduce fat to 30% of total calories
- saturated fat should comprise less than 10% of total calories
- cholesterol intake should be less than 300 mg/day
- 5 or more servings of vegetables and fruits/day
- 6 or more servings of breads, cereals and legumes/day
- about 55% of calories from carbohydrates (mostly complex)
- evidence for fiber is not conclusive
- balance food intake and physical activity to maintain appropriate body weight
- intake of protein should not exceed more than 2 times the RDA
- 2400 mg/day sodium or less
- the committee does not recommend calcium supplementation for the general population
- avoid taking dietary supplements in excess of RDAs.

A copy of Executive Summary: Diet and Health, Implications for Reducing Chronic Disease Risk is included as Appendix D.

The next speaker, Ms. Elena Carbone Britt from the Department of Health and Human Services, spoke about the Surgeon General's report on Diet and Health. She noted that the report acknowledges that ten leading causes of death are related to food. The target audience for the report is health professionals. The Surgeon General's report considers policy implications evolving from scientific findings. For example, the recommendations are very similar to those of the FNB's Diet and Health Report. The Surgeon General recommends reduction in total dietary fat, especially saturated fat, because of the relationship to the development of several chronic disease conditions. Most of the other recommendations are similar to the FNB's report. The main difference is that the FNB's report is quantitative whereas the Surgeon General's Report is not. The recommendations from the Surgeon General Report are listed in Table 1. below

Table 1
Recommendations

Issues for Most People:

- *Fats and cholesterol:* Reduce consumption of fat (especially saturated fat) and cholesterol. Choose foods relatively low in these substances, such as vegetables, fruits, whole grain foods, fish, poultry, lean meats, and low-fat dairy products. Use food preparation methods that add little or no fat.

- *Energy and weight control:* Achieve and maintain a desirable body weight. To do so, choose a dietary pattern in which energy (caloric) intake is consistent with energy expenditure. To reduce energy intake, limit consumption of foods relatively high in calories, fats, and sugars, and minimize alcohol consumption. Increase energy expenditure through regular and sustained physical activity.

- *Complex carbohydrates and fiber:* Increase consumption of whole grain foods and cereal products, vegetables (including dried beans and peas), and fruits.

- *Sodium:* Reduce intake of sodium by choosing foods relatively low in sodium and limiting the amount of salt added in food preparation and at the table.

- *Alcohol:* To reduce the risk for chronic disease, take alcohol only in moderation (no more than two drinks a day), if at all. Avoid drinking any alcohol before or while driving, operating machinery, taking medications, or engaging in any other activity requiring judgment. Avoid drinking alcohol while pregnant.

Other Issues for Some People:

- *Fluoride:* Community water systems should contain fluoride at optimal levels for prevention of tooth decay. If such water is not available, use other appropriate sources of fluoride.

- *Sugars:* Those who are particularly vulnerable to dental caries (cavities), especially children, should limit their consumption and frequency of use of foods high in sugars.

- *Calcium:* Adolescent girls and adult women should increase consumption of foods high in calcium, including low-fat dairy products.

- *Iron:* Children, adolescents, and women of childbearing age should be sure to consume foods that are good sources of iron, such as lean meats, fish, certain beans, and iron-enriched cereals and whole grain products. This issue is of special concern for low-income families.

from: The Surgeon General's Report on Nutrition and Health (1988), U.S. Department of Health and Human Services, Public Health Service DHHS(PHS) Publication No. 88-502120, page 3.

A copy of the full Summary and Recommendations from this report is included as Appendix E.

Next, Ms. Britt discussed the Year 2000 Objectives for the nation (See Appendix F.) Nutrition is among the objectives included. Included for the first time are populations that are hard to reach. These objectives will be published in the summer of 1990. The objectives include: reducing growth retardation in children; reducing iron deficiency; reducing intake of dietary fat; increasing calcium intake; increasing dietary fiber and complex carbohydrates; reducing excessive alcohol consumption and reducing sodium intake; increasing the proportion of women who breast feed and; increasing the overall awareness of the relationship between nutrition and health.

The fourth speaker was Dr. Lenora Moragne, Program Officer FNB. She discussed implementation strategies at a national level. The Implementation study, she explained, is funded by the National Cancer Institute and Kaiser (See Appendix G.) Its task is to propose detailed strategies and options for the implementation of dietary guidelines by government agencies, nutrition professionals, medical and allied health fields and educational institutions, and to the extent possible, to examine the potential benefits and costs of implementing dietary guidelines. The disciplines represented by the committee members include such areas as nutrition education, agriculture, business and clinical nutrition. The Chairman of the 20 member committee is Dr. Edward Brandt, Dean, School of Medicine, University of Oklahoma.

Dr. Moragne noted that the committee held a public meeting in July 1988 to solicit comments from the general public and consumer groups. The final report is due in early 1990.

Following these reports the discussion then turned to a review of the activities that are currently a part of the Army's nutrition and health promotion program.

LTC Judith Turcotte, Nutrition Staff Officer, Personnel Readiness Division, discussed some of the activities of the Army in the promotion of nutrition and health for its personnel. She showed a video tape "Fit to Win," that is used as a part of this program. The tape presents the relationship between nutrition and performance. She also reviewed the Army's Health Risk Assessment (HRA) tool which is used as a wellness check (see Appendix H). This form is completed every five years, or more often if necessary. The form includes several questions concerning dietary habits, as well as other factors associated with good health. LTC Turcotte also summarized the range of educational-health promotion activities and the responsibilities for their conduct that are a part of the program.

COL Cronin, Chief, Dietician Section, Army Med. Spec. Corp., spoke more specifically about the nutrition initiatives undertaken by the Army and this Army's nutrition goals. These are summarized the appendix (Appendix I). The overall goal, she commented, was to improve the health and readiness of the Army through nutrition. The Army's dietary goals are to reduce fat to 30% of calories by 1998; reduce cholesterol to less than 300 mg/day and reduce sodium to 1400-1700 mg/1000 kcal. This will help to ensure that soldiers in the field get optimal and adequate nutrition. "If it isn't eaten it isn't nutrition."

LTC Wayne Askew spoke about the evaluation of the dietary intakes of soldiers in garrison (see Appendix J). Studies have been conducted to evaluate the nutritional composition and adequacy of meals consumed by soldiers in garrison dining halls in several studies conducted since 1986. Techniques have been developed and evaluated for visual estimates of food intake, recipes have been modified and actual food preparation in the mess kitchens monitored. A nutrient data bank for recipes and products actually used in the test facilities has been created. A detailed study has been initiated at Ft. Jackson, Miss., looking at a population of soldiers initially during the 1st to 3rd week of basic training. This project is evaluating specific nutrient intakes in comparison with the MRDA. Intake of selected vitamins as well as the minerals calcium, phosphorus, iron, and sodium are being determined. To help decrease fat intake at Ft. Jackson, 2% fat milk in bulk dispensers and fresh fruit are being offered as alternatives to high fat deserts.

LTC Askew presented some initial data from the basic trainee study at Ft. Jackson concerning fat intakes and serum lipid levels in both males and females. (see Appendix J). The impact of educational efforts to reduce fat intakes in average soldiers were illustrated by trends in total fat intakes in military dining facilities based on studies as early as 1952. It appears there has been a significant downward trend in the per cent of fat calories consumed by soldiers in dining facilities in recent years. Data were also presented on trends in cholesterol intake in military dining facilities. These data do not indicate any significant reduction in cholesterol intakes, probably due to the availability of eggs at breakfast in the mess halls during all of these time periods. Sodium intakes measured after 1986 included salt added at the table whereas prior data (1971-1976) did not. Taking this addition into consideration (added table salt averaged 4-10% of total) there was no change in trends in sodium intakes over the period 1971-1988.

The committee agenda included plans for the committee to consider the relevance to the military environment of the diet and health recommendations presented from the NAS and Surgeon General's reports and to suggest priorities for the military in expanding its efforts toward health promotion initiatives for soldiers and their families. Unfortunately, severely inclement weather caused the early

closing of the NAS office and disruption of air travel that forced an early adjournment of the committee. This item will be included on the agenda of another CMNR meeting during 1990.

The meeting adjourned following a brief discussion of the plans for the February 6-7 workshop on "Body Composition and Military Performance."

APPENDIX IIb.

Presentation Graphics: Implementation and Evaluation of Nutrition Initiatives in the Military.

Col. David D. Schnakenberg

Implementation and Evaluation of Nutrition Initiatives in the Military

Implementation and Evaluation of Nutrition Initiatives in the Military: Figure 1

Nutrition Responsibilities of the Army Surgeon General

- **Establish nutrition policies for DoD**
- **Establish dietary allowances for military personnel**
- **Establish nutritional standards for combat rations**
- **Evaluate current and proposed rations and feeding systems**
- **Develop and implement nutrition education programs**
- **Provide nutritional advice to military food service activities**
- **Perform military nutrition R&D**
- **Provide dietary recommendations to promote and maintain health**

Implementation and Evaluation of Nutrition Initiatives in the Military: Figure 2

Military Recommended Dietary Allowances (MRDA)

- **Adapted from latest NAS/NRC recommended dietary allowances (RDA)**
- **Applicable to moderately active military personnel, ages 17-50 years**
- **Published in Tri-Service Regulation "Nutrition Allowances, Standards, and Education"**
- **Most recent (1985) revision reviewed by NAS/NRC Committee on Military Nutrition Research also incorporated the DHHS/USDA seven dietary guidelines**
- **Recommends adjustments for extreme climates and physical activity**

Fat, Sodium and Cholesterol Recommendations in 1985 MRDA

- FAT
  - Total fat calories should not exceed 35% in Garrison
  - Polyunsaturated fat intake at current 7% of calories
- SODIUM
  - Currently impractical to implement RDA safe and adequate levels of 1100 to 3300 mg sodium/day
  - Established goal of 1700 mg sodium/1000 Kcal
  - Clarified goal in 1986 to 1400-1700 mg sodium/1000 Kcal
- CHOLESTEROL - no recommendation

Uses of MRDA by DoD Health and Food Service Professionals

- Nutrition and food service policy
- Recipe and menu development
- Food service equipment planning
- Cook and food service manager training
- Nutrition education and health promotion
- Food and nutrition research and development
- Ration procurement specifications
- Nutritional evaluation of food service systems
- Dietary assessment of military populations

Implementation and Evaluation of Nutrition Initiatives in the Military: Figure 5

Nutrition Initiatives For Garrison Feeding

- Initiated by Army in 1985
- Component of health promotion program
- Focus to reduce total fat intakes to a target of not more than 35% of calories
- Approaches
  - Serve low fat milk
  - Modify menus, recipes, food preparation
  - Educate cooks and diners
- Conduct nutrition assessments to evaluate effectiveness

Implementation and Evaluation of Nutrition Initiatives in the Military: Figure 6

APPENDIX IIc.

Preliminary Results of Nutritional Surveys in United States Army Camps. Amer J Pub Hlth, **1919 vol. 9(6), 401-413.**

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PRELIMINARY RESULTS OF NUTRITIONAL SURVEYS IN UNITED STATES ARMY CAMPS.

JOHN R. MURLIN, *Lieut.-Colonel, Sanitary Corps,*
and
CASPAR W. MILLER, *Major, Medical Corps,*
Office of Surgeon-General, Washington, D. C.

Abstract of paper read before Food and Drugs Section, American Public Health Association, at Chicago, Ill., December 9, 1918.

Before the war there had never been presented to food experts in this country an opportunity for the extended study of nutrition comparable to that afforded these investigators. Their report sets forth details of observations which support the "training ration," which is appetizing and secures a proper distribution of the nutrients.

THE Food Division of the Surgeon-General's Office,* organized early in September, 1917, for the purpose of "safeguarding the nutritional interests of the Army," was confronted at the outset with various questions relating to the amount of food required by soldiers in training. According to the best American authorities on nutrition the garrison ration of the U. S. Army provided much more than would seem to be required except for very heavy muscular work under rather severe conditions of weather and climate. These opinions were freely voiced in a conference† called by Dr. Alonzo E. Taylor on behalf of Mr. Herbert Hoover, food administrator, at the Food Administration Headquarters in Washington on September 20, 1917 "for the purpose of considering questions relating to the subsistence of the Army."

Contrary opinions were expressed by officers of the Army who had had much experience in small organizations with the army ration. Furthermore, it was explained by General Henry Sharpe, that the garrison ration as laid down in the

* Later established by effect of War Department, General Orders No. 67, 1918, as the Division of Food and Nutrition of the Medical Department, U. S. Army.

† There were present at this conference representatives of the Medical Department of the National Defense Council, of the U. S. Food Administration, of the Surgeon-General's Office, of the Quartermaster-General's Office, of the Bureau of Chemistry, Department of Agriculture, and of the U. S. Navy. The following named were in attendance: Surgeon-General W. C. Gorgas, Quartermaster-General Henry C. Sharpe, Colonel Puckle of the British Army, Col. E. L. Munson and Col. F. F. Russell, Medical Corps, Rear-Admiral Cary Grayson, Dr. Carl L. Alsberg, Dr. F. G. Benedict, Dr. Herman Biggs, Prof. R. H. Chittenden, Prof. D. L. Edsall, Mr. Herbert Hoover, Major T. C. Janeway, Dr. Vernon Kellogg, Dr. C. L. Langworthy, Prof. Graham Lusk, Prof. Lafayette B. Mendel, Prof. E. V. McCollum, Prof. R. M. Pearce, Prof. Raymond Pearl, Dr. Alonzo E. Taylor, Dr. R. L. Wilbur, Prof. W. H. Welch and Major John R. Murlin.

army regulations is not of necessity the amount of food issued; that the ration as defined by regulations is "the allowance for subsistence of one man for one day," the money allowance being calculated upon certain fixed amounts of the ration components* by the local quartermaster each month, so that it varies constantly with market prices. The system of savings in vogue was also explained, according to which the unexpended balance of the ration allowance accrues to the credit of the organization conducting the mess and according to which also, varying somewhat with local conditions but likely to obtain in all training camps in this country, a certain percentage of the ration allowance can be drawn in money and be spent in the local market for fresh vegetables or such other articles not carried by the camp quartermaster, as may please the fancy of the mess sergeant.

Mr. Hoover and Dr. R. L. Wilbur both alluded to the numerous complaints, which had come to the office of the U. S. Food Administration from civilians visiting army camps thus far established, of the enormous wastage of food to be seen in those camps.

There was evident at this conference a deep reluctance on the part of the civilian authorities in nutrition, as well as on the part of army officers to make any arbitrary reduction in the ration allowance, even though it might be conceded that the soldiers could live on less. To meet this situation in the face of a threatened world shortage of food it was proposed by the director of the Food Division of the Surgeon-General's Office, that nutritional surveys be conducted by experienced observers in the several army camps with a view to determine quantitatively the actual consumption and the actual wastage of food. The plan proposed apparently met with the approval of all present although no vote to this effect was taken. It was unanimously approved by a group of experts* in nutrition who had agreed to act as an Advisory Council to the Division of Food and Nutrition, and was formally approved by the surgeon-general and informally by the quartermaster-general at that time.

While the immediate motive which prompted the nutritional surveys was the determination of the actual food requirements of the Army in the interest both of satisfactory nutrition and of food conservation, other objects were kept steadily in view, as may be inferred from the following excerpt from a memorandum submitted to the surgeon-general, and by him embodied in a letter requesting authority for the surveys from the chief-of-staff:

September 17, 1917.

1. PURPOSE. The object of this Division is primarily to safeguard the nutritional interests of the Army; (1) by means of competent inspection of the food supplied to the camps with reference especially to its nutritional value; (2) by seeking to improve the mess conditions (cooking and serving of the food) with special attention to the matter of food economy, bearing in mind that palatability and proper cooking are great factors in determining the economical utilization of food in the physiological, no less than in the financial sense; (3) by studying constantly the suitability of the ration as a working man's diet. Does it afford the proper amount and distribution of nutrients? What amount of variability is there, as between different mess houses of the same regiment and between different camps? Any intelligent alteration of the ration from time to time must be based on facts, and it is the purpose of this Division to get facts.

METHOD.

The method of conducting a nutritional survey was in brief as follows: A survey party reporting to the command-

* See paragraph 1221, U. S. Army Regulations, 1913, corrected to 1918.

* Members of this Advisory Council were Dr. C. L. Alsberg, Dr. F. G. Benedict, Prof. Graham Lusk, Prof. L. B. Mendel, Prof. E. V. McCollum and Prof. A. J. Taylor.

ing officer, usually spent the first few days in becoming acquainted with the camp and in learning where typical messes could be found. The advice of the sanitary inspector and of the officer in charge of the School for Bakers and Cooks where such schools existed, was sought in determining which messes were fairly representative of the entire camp. The most highly efficient, as well as the poorest messes, were purposely avoided.

The first few days were spent also in a preliminary inspection of the subsistence stores and of the food on hand at the mess houses.

The number of messes selected for quantitative study varied all the way from a single mess at Camp Crane, Allentown, Pa., where all of the Ambulance Service students were fed at one large mess in the same hall, to 40 messes at Camp Lewis, studied by Capt. P. E. Howe's party in April, 1918. The average number of messes studied was in the neighborhood of half a dozen.

The quantitative survey was made according to the method which had been followed by the U. S. Department of Agriculture in making studies of the food consumption of people in small and large groups and which had been found satisfactory by Major Frank C. Gephart* in a study of food consumption and food waste at St. Paul's School, Concord, N. H.

This method had been employed also by the director of the Division of Food and Nutrition in a survey made by him at the first R. O. T. C., 1917, Plattsburg Barracks, New York. It consists essentially in making careful inventories by weight of all foods in the store room at the beginning and at the end of a definite period and of all accessions to stock during the period. Concurrently, the garbage is carefully separated into edible and inedible portions; the former is weighed, ground through a meat grinder, or chopped with spades according to the amount, and a sample taken for analysis. Any foods whose composition is in question are likewise analyzed. Deducting the second inventory from the first plus accessions to stock, and reducing to protein, fat, carbohydrate and energy content, and finally subtracting protein, fat, carbohydrate and energy found in the edible waste, the net consumption of food per man per day may be calculated.

Table I shows the average amount of food supplied, wasted and consumed per man per day; the distribution of fuel value in the food consumed; the percentage of each class of food wasted, as well as the percentage of the total fuel value wasted; the cost of the food consumed per man per day; the value of the food wasted; and the average amounts of total waste and edible waste. It will be seen that the average amount of food consumed has not changed materially with the increased number of messes This is significant as showing that the number of messes surveyed is actually representative of the whole army in training.

Table II, comprising 385 messes, gives the consumption in the various kinds of messes. Differences are here brought out which are not apparent in Table I. A few messes of officers, cadets and prisoners were considered so atypical that they are not included in any of these groups.

The average total consumption of food at the mess amounts to a little over 3,600 calories. Since it was found by weighing 1,000 men (Camps Grant, Dodge, Funston and Devens) that the average soldier after five months training weighs 146.5 pounds net, this 3,600 calories amounts to about 24.6 calories per pound of body weight.

* Frank C. Gephart: Report on a Dietary Study of St. Paul's School, Concord, N. H. *Boston Medical and Surgical Journal*, Vol. CLXXVI, No. 1, pages 17–22, January 4, 1917.

TABLE I.

NUTRIENTS AND ENERGY CONSUMED IN TRAINING CAMPS.

	Food per Man per Day						
	Nutrients	Supplied	Wasted	Consumed	Consumed Distr. of Cal.	Wasted	Per Man per Day
Averages 49 messes	Protein gm	139	12	127	14 %	9 %	Consumed cost 41.39 ¢
	Fat gm	129	14	115	30 %	11 %	Waste cost 3.57 ¢
	Carbohydrate gm	539	40	499	56 %	7 %	Total waste --- -- lb.
	Fuel Value Cal	3980	343	3637	100 %	9 %	Edible waste ------ lb.
Averages 68 messes	Protein gm	139	11	128	14 %	8 %	Consumed cost 40.82 ¢
	Fat gm	127	13	114	29 %	10 %	Waste cost 3.51 ¢
	Carbohydrate gm	537	37	500	57 %	7 %	Total waste .82 lb.
	Fuel Value Cal	3853	318	3635	100 %	8 %	Edible waste .45 lb.
Averages 85 messes	Protein gm	139	10	129	14 %	7 %	Consumed cost 41.58 ¢
	Fat gm	130	12	118	30 %	9 %	Waste cost 3.41 ¢
	Carbohydrate gm	536	35	501	56 %	7 %	Total waste .82 lb.
	Fuel Value Cal	3977	297	3680	100 %	7 %	Edible waste .43 lb.
Averages 143 messes	Protein gm	139	10	129	14 %	7 %	Consumed cost 42.55 ¢
	Fat gm	132	12	120	30 %	9 %	Waste cost 3.10 ¢
	Carbohydrate gm	534	33	501	56 %	6 %	Total waste .85 lb.
	Fuel Value Cal	3987	288	3699	100 %	7 %	Edible waste .44 lb.
Averages 185 messes	Protein gm	138	9	129	14 %	7 %	Consumed cost 42.17 ¢
	Fat gm	130	12	118	30 %	9 %	Waste cost 2.99 ¢
	Carbohydrate gm	529	32	497	56 %	6 %	Total waste .82 lb.
	Fuel Value Cal	3944	280	3664	100 %	7 %	Edible waste .43 lb.
Averages 213 messes	Protein gm	138	9	129	14 %	7 %	Consumed cost 42.75 ¢
	Fat gm	133	12	121	31 %	9 %	Waste cost 3.00 ¢
	Carbohydrate gm	527	31	496	55 %	6 %	Total waste .83 lb.
	Fuel Value Cal	3963	276	3687	100 %	7 %	Edible waste .42 lb.
Averages 361 messes	Protein gm	133	9	124	14 %	7 %	Consumed cost 43.35 ¢
	Fat gm	130	15	115	30 %	12 %	Waste cost 3.46 ¢
	Carbohydrate gm	513	32	481	56 %	6 %	Total waste .86 lb.
	Fuel Value Cal	3858	308	3550	100 %	8 %	Edible waste .40 lb.
Averages 427 messes	Protein gm	131	9	122	14 %	7 %	Consumed cost 44.06 ¢
	Fat gm	134	11	123	31 %	8 %	Waste cost 3.20 ¢
	Carbohydrate gm	516	31	485	55 %	6 %	Total waste 0.80 lb.
	Fuel Value Cal	3899	266	3633	100 %	7 %	Edible waste 0.38 lb.

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TABLE II.

NUTRIENTS AND ENERGY CONSUMED PER MAN PER DAY BY TROOPS UNDER DIFFERENT CONDITIONS.

	No. of Messes	Protein	Fat	Carbohydrates	Fuel Value
		Gms.	Gms.	Gms.	Cals.
Line troops in active training and in Spruce Production Camps	263	127	120	483	3,615
Construction Camps, mechanics only	38	118	119	469	3,510
Troops preparing for immediate overseas service	11	128	126	496	3,730
Medical troops, excluding patient messes	20	113	124	436	3,405
Messes under quarantine, activity of men not restricted	17	125	124	496	3,700
Recruits, usually just inoculated	36	117	109	435	3,275
Average of above 565 messes		124	119	475	3,560

To this must be added the amount of nutrients consumed from the post exchange or canteen. Survey parties have made estimates of the man per day consumption from the canteens in a large majority of the surveys; some of individual companies, some of entire regiments, and a few like Camp Crane and Chanute Field, of entire camps. The average daily consumption from the canteen is 365 calories; the average total consumption of nutrients, therefore, is 3,998 (3,633 plus 365) calories or 27 calories per pound. According to Lusk, 3,898 calories is the amount required by a mature soldier of this weight in order to maintain his body and to do a forced march on a level road of thirty miles in ten hours, carrying a pack and other equipment weighing 44 pounds. This coincidence is striking. It is evident, therefore, that the soldier in training eats enough every day to do this large amount or work, or provide for the exigencies of unfavorable weather conditions. If the work is not done, he accumulates fat; and as a matter of fact the observation of this Division (Camps Devens, Grant, Dodge, Funston) indicate an average gain of 7½ pounds in three months. It would not be proper to regard this gain as entirely consisting of fat, however, since there is undoubtedly, at least in the case of men from sedentary occupations, considerable "muscling up." There is also increase in stature, or "straightening up," of the younger men.

It is particularly interesting to note in Table I the constancy of distribution of the fuel value as to the three sources of energy,—protein, fat and carbohydrate. With the addition of the canteen purchases the final distribution, however, is somewhat different (see note at end of Table IV).

Most of the foods purchased at the post exchange are chocolates, soft drinks, cakes and pies. The fact that soldiers insist upon consuming such quantities of these articles (representing about 10 per cent of their total energy) constitutes a direct criticism of the mess. It is better to supply at least a part of the craved sweets in the ration. It will then be possible to discourage such sales and to safeguard the soldier against the sometimes injurious products manufactured by ignorant and unscrupulous firms. Moreover, it is interesting to note that although these post exchange goods consist chiefly of carbohydrates, the cheapest of the three classes of foods, the average cost of 1,000 calories is 28.2 cents; while the average cost of the same energy in the mess, where nearly one-half is supplied by the more expensive protein and fat, is only 12 cents.

The average energy value of the food supplied in 427 messes is 3,891 calories per man per day. The average edible

TABLE III

MONTHLY AVERAGES

Line Organizations, only

	Nutrients	Food per Man per Day — Supplied	Wasted	Consumed	Consumed Distr. of FV	Wasted	Per Man per Day	
November 1917	Protein gm	139	13	126	14 %	9 %	Consumed cost	42.04 ¢
— — — —	Fat gm	133	15	118	30 %	11 %	Waste cost	3.98 ¢
32 messes	Carbohydrate gm	546	45	501	56 %	8 %	Total waste	.85 lb.
— — — —	Fuel Value Cal	4045	377	3668	100 %	9 %	Edible waste	.52 lb.
December 1917	Protein gm	144	8	136	15 %	6 %	Consumed cost	40.21 ¢
— — — —	Fat gm	127	10	117	29 %	8 %	Waste cost	2.46 ¢
37 messes	Carbohydrate gm	545	29	516	56 %	5 %	Total waste	.87 lb.
— — — —	Fuel Value Cal	4006	245	3761	100 %	6 %	Edible waste	.45 lb.
January 1918	Protein gm	137	8	129	14 %	6 %	Consumed cost	42.31 ¢
— — — —	Fat gm	134	11	123	31 %	8 %	Waste cost	2.66 ¢
45 messes	Carbohydrate gm	528	28	500	55 %	5 %	Total waste	.71 lb.
— — — —	Fuel Value Cal	3973	250	3723	100 %	6 %	Edible waste	.33 lb.
February 1918	Protein gm	137	10	127	14 %	7 %	Consumed cost	41.74 ¢
— — — —	Fat gm	131	12	119	31 %	9 %	Waste cost	2.96 ¢
30 messes	Carbohydrate gm	514	30	484	55 %	6 %	Total waste	.78 lb.
— — — —	Fuel Value Cal	3887	276	3611	100 %	7 %	Edible waste	.35 lb.
March, 1918	Protein gm	133	9	124	14 %	7 %	Consumed cost	42.67 ¢
— — — —	Fat gm	136	11	125	31 %	8 %	Waste cost	2.73 ¢
53 messes	Carbohydrate gm	525	28	497	55 %	5 %	Total waste	.87 lb.
— — — —	Fuel Value Cal	3963	254	3709	100 %	6 %	Edible waste	.37 lb.
April, 1918	Protein gm	133	8	125	14 %	6 %	Consumed cost	44.12 ¢
— — — —	Fat gm	134	10	124	33 %	7 %	Waste cost	2.85 ¢
60 messes	Carbohydrate gm	488	29	459	53 %	6 %	Total waste	.95 lb.
— — — —	Fuel Value Cal	3792	245	3547	100 %	6 %	Edible waste	.33 lb.
May, 1918	Protein gm	126	7	119	14 %	6 %	Consumed cost	41.98 ¢
— — — —	Fat gm	122	7	115	31 %	6 %	Waste cost	2.18 ¢
43 messes	Carbohydrate gm	497	24	473	55 %	5 %	Total waste	.70 lb.
— — — —	Fuel Value Cal	3689	192	3497	100 %	5 %	Edible waste	.29 lb.
June, 1918	Protein gm	129	8	121	14 %	6 %	Consumed cost	45.59 ¢
— — — —	Fat gm	129	12	117	31 %	9 %	Waste cost	3.29 ¢
16 messes	Carbohydrate gm	495	31	464	55 %	6 %	Total waste	.90 lb.
— — — —	Fuel Value Cal	3758	271	3487	100 %	7 %	Edible waste	.37 lb.

waste is 266 calories per man per day, which is 7.0 of the energy supplied. The weight of the edible waste was 0.38 pounds; and since it has been found that the average cost of edible waste is 7.9 cents per pound, this 0.38 pound represents a loss of about 3.0 cents. The principal items of waste are meat, bread and potatoes, these being the articles drawn in largest amounts.

Seasonal Variation.

The nutritional surveys have demonstrated for the first time on a satisfactory basis the larger consumption by men doing equally hard muscular work in cold weather. This fact was already well-known empirically, but, so far as known to the writers, had failed of demonstration scientifically. This seasonal variation is shown in the accompanying table which exhibits the actual average consumption of food per man per day in the different months beginning October, 1917, and ending December, 1918. The ratio of the different classes of foodstuffs consumed, however, remains nearly constant throughout the entire period of the survey.

Another factor affecting the consumption of food is the length of time in service. When the raw recruit begins training he is under various abnormal conditions all tending to reduce food consumption. It is the period of typhoid inoculation; the recruit is frequently homesick; unfamiliarity with his surroundings to a considerable extent prevents him from making himself as comfortable as he will later become; he frequently experiences dislike for the cooking and menu, which is later overcome in part because the cooks themselves improve, and in part by habituation. Studies of the body weights of recruits exhibit in this period a loss of several pounds which, however, is recovered by the end of the third or fourth week. The difference in food consumption is shown in the following comparison:

Mess consumption of recruits, average of 36 messes	3,275 calories
Mess consumption after men have been in camp three or more weeks, average of 251 messes	3,750 calories

In both cases the men were in line training and doing fairly heavy work.

While much work of inspection was done by the survey parties the chief object of their visits was to assist in the adoption of such measures as would result in proper nutrition of the soldier. Granting proper stimulus to the digestive organs resulting from hunger, proper nutrition is accomplished when food is selected with reference to the proper distribution of nutrients and is properly cooked and served. The garrison ration as issued (A. R. 1221) which is the *basis of feeding* for all training camps is a fairly well-balanced ration as regards protein, fat and carbohydrate, but not so as regards the mineral salts. The exact dietary selected by the average mess sergeant from the foods available at subsistence stores and from local sources has proved to be not so well-balanced. There is an excessive proportion of protein and, from the economical point of view, an unnecessarily large proportion of fat. Reference will be made later to this average dietary which has been selected in the training camps.

Instruction in the nutritional value of protein, fat, carbohydrate, mineral salts and vitamines has been given by individual interview and by conference with mess sergeants and mess officers of regiments in practically all the camps visited. This has resulted in a better understanding of their responsibilities on the part of mess officer and mess sergeant. Instruction has been given also in the construction of menus so as to insure a sufficient supply, without excess, of each of

the important foodstuffs. It is the general concensus of opinion amongst experts in nutrition that an excess of protein is undesirable in the dietary of a hard-working man, since muscular work does not involve destruction of muscular tissue beyond the amount sustained by that tissue in muscular rest. The amount of protein, which in general is held to be sufficient to repair all the wastes of the body and to supply an adequate reserve, is 13 per cent of the total energy intake. It seems to be a matter of indifference to the muscles whether they receive their energy from carbohydrate or from fat, except that carbohydrate yields its energy more rapidly than does fat. Hard muscular work, therefore, can be done on a high carbohydrate diet or upon a high fat diet. It is of general experience, however, that muscular work is done *with less effort* if there is a plentiful supply of carbohydrate. Moerover, it is well known that carbohydrate is a cheaper source of muscular energy than is fat. All the requirements for training of soldiers, therefore, would be met by a dietary supplying 12½ per cent of the total energy in the form of protein, 25 per cent in the form of fat and 62½ per cent in the form of carbohydrate. This distribution has been fixed upon as approximating the ideal for the training camps, the exact proportion of 1:2:5 having been chosen as a matter of convenience in devising a mechanical means of balancing the dietary.*

The Suitability of the Garrison Ration.

It has already been mentioned on page 401 that the garrison ration would seem to provide much more than the necessary amount of energy for the training period. The nutritional surveys have confirmed this view beyond peradventure. Even with moderate efficiency an organization can, under the existing system, effect very large savings. This obviously leads to wastefulness in the purchase of foods not needed, and numerous instances could be cited of almost profligate use of mess funds accumulated in only a few months of training.

In summary the garrison ration exhibits the following defects: (1) it provides more food than necessary; (2) it is not well balanced as regards the mineral salts; (3) there is an excess of fat. The first of these defects leads to wastefulness; the third makes it impossible to issue this ration in kind.*

A study of the actual average amounts of different articles of food selected on free choice by the mess sergeants, following, it is presumed, the express wishes of the men in their organizations, furnishes a safe basis for readjustment of the ration. Table V exhibits a comparison of the garrison ration with the average amounts of the various articles of food supplied in 400 messes scattered all over the United States and distributed fairly evenly throughout the year. In parallel columns also are shown the amounts of the various component articles recommended by the Division of Food and Nutrition as furnishing a better distribution of nutrients and yielding an adequate amount of energy even for the extreme needs of the soldiers in training. The amounts proposed in most instances follow closely the actual average consumption of food supplied throughout the period of heaviest training. It will be noted that the garrison ration provides an excess of meats of all classes and an enormous excess of flour or bread, slightly more than the amount needed of vegetables, scarcely enough of fruits and coffee and a wholly

* This mechanical "ration balance" will be described in a separate communication.

* Experience in the American Expeditionary Force has confirmed this opinion.

TABLE IV.

COMPARISON OF GARRISON RATION WITH AVERAGE AMOUNTS SUPPLIED IN 400 MESSES.

Food	Garrison Ration A. R. 1221		Supplied in 400 Messes		Proposed Training Ration		
	Components	Substitutes	Components	Substitutes	Components	Substitutes on Basis of	
						Energy	Protein
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.
Beef, fresh	14		8.85		12		
Cheese						6.22	7.22
Corned beef (canned)						14.7	7.2
Eggs						19.72	15.68
Fish, fresh (salmon)				0.40		18.1	10.8
Fish, fresh (cod)						73.4	22.4
Fish, preserved				0.27		23.2	8.3
Hash, corned beef				0.19		22.7	13.2
Liver				0.22		21.9	9.3
Mutton						9.07	14.5
Pork				0.75		9.8	12.9
Poultry				0.19		13.1	12.6
Veal				0.26		20.7	10.8
Total beef, etc.	14		8.85	2.28	12		
Total beef, etc.	14		11.13		12		
Bacon		3.6	0.56		2		
Ham				0.61		3.7	1.3
Sausage, pork				0.86		4.7	0.9
Total bacon, etc.		3.6	0.56	1.47	2		
Total bacon, etc.	3.6		2.03		2		
Flour	18		2.38		10		
Bread, soft		18		6.59		10.67	10.96
Bread, hard		16		0.08		9.22	10.00
Total flour, etc.	18		2.38	6.67	10		
Total flour, etc.	18		9.05		10		
Other cereals (oatmeal)			0.38		1.5		
Corn meal				0.51		1.68	2.70
Farina				0.45		1.65	2.50
Total other cereals			0.38	0.96	1.5		
Total other cereals			1.34		1.5		
Baking Powder	0.08				0.08		
Beans, dried	1.2		1.09		1.5		
Beans, baked, canned						4.01	4.90
Peas, canned				0.82	1.0		
Peas, dried						0.16	0.14
Corn, canned				0.80	1.0		
Total beans, etc.	1.2		1.09	1.62	3.5		
Total beans, etc.	1.2		2.71		3.5		

TABLE IV.—*Continued.*

Food	Garrison Ration A. R. 1221		Supplied in 400 Messes		Proposed Training Ration		
	Components	Substitutes	Components	Substitutes	Components	Substitutes on Basis of	
						Energy	Protein
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.
Rice		0.8	0.43		1.0		
Hominy				0.30		1.00	1.04
Macaroni and Spaghetti				0.27		0.95	1.01
Corn Starch						0.97	
Total rice, etc.		0.8	0.43	0.57	1.0		
Total rice, etc.	0.8		1.00		1.0		
Potatoes, white	14		12.22		14		
Potatoes, white, dehy.						2.72	2.77
Potatoes, sweet				0.48	2.5		
Potatoes, sweet, dehy.						0.70	0.68
Total Potatoes	14		12.22	0.48	16.5		
Total Potatoes	14		12.70		16.5		
Onions, fresh		4	0.74		4		
Onions, dehy.						0.48	
Cabbage, fresh				1.11		6.44	
Cabbage, dehy.						0.52	
Beets, fresh				0.09		4.63	
Beets, dehy.						0.51	
Carrots, fresh				0.14		4.86	
Carrots, dehy.						0.49	
Spinach, fresh				0.21		7.07	
Spinach, dehy.						0.61	
Turnips, fresh				0.35		6.24	
Turnips, dehy.						0.50	
Total onions, etc.		4	0.74	1.90	4		
Total onions, etc.	4		2.64[2]		4		
Tomatoes, canned		2	1.41		2		
Tomatoes, dehy.						0.13	
Total Tomatoes		4	1.41		2		
Total Tomatoes	2		1.41[2]		2		
Prunes	0.38		0.46		0.5		
Apples, evap.		0.13	0.13[2]		0.25		
Peaches, evap.		0.13	0.32		0.25		
or pears, evap.						0.27	
or apricots						0.25	
or raisins and currants				0.13[2]		0.22	
Jam or Fruit Butter		0.64	0.59		1.00		
Total prunes, etc.	0.38	0.90	1.50	0.13	2.00		
Total prunes, etc.	1.28		1.63		2.00		

TABLE IV—*Continued.*

Food	Garrison Ration A. R. 1221		Supplied in 400 Messes		Proposed Training Ration	
	Components	Substitutes	Components	Substitutes	Components	Substitutes on Basis of Energy
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.
Bananas				0.34	1.5	
Apples						2.04
Cranberries						2.08
Lemons						3.1
Oranges				0.94		2.50
Peaches						2.88
Pears						1.72
Pineapple				0.19		0.62
Total fresh fruits				1.47	1.5	
Total fresh fruits			1.47[2]		1.5 (as banana)	
Coffee	1.12		1.08		1.2	
Tea						0.35
Cocoa						0.5
Total coffee, etc.	1.12		1.08		1.2	
Total coffee, etc.	1.12		1.08[2]		1.2	
Sugar	3.2		3.81		5	
Milk, evaporated	0.5		2.34		2.5	
Milk, fresh or reconstituted						5.30
Total milk	0.5		2.34		2.5	
Total milk	0.5		2.34		2.5	
Vinegar	0.64[4]					
or						
Vinegar	0.32				0.12	
Pickles		0.32			0.18	
Total vinegar, etc.	0.32	0.32			0.30	
Total vinegar, etc.	0.64				0.30[5]	
Pepper	0.04				0.02	
Salt	0.64				0.5	
Cinnamon	0.014				0.014	
Cloves		0.014				
Nutmeg		0.014				0.014
Ginger		0.014				0.014
Total spices	0.014		0.003[2]		0.014	
Lard	0.32		0.11			
Lard substitute		0.32	0.66			
Total lard, etc.	0.32	0.32	0.77			
Total lard, etc.	0.64		0.77			

TABLE IV—*Continued.*

Food	Garrison Ration A. R. 1221		Supplied in 400 Messes		Proposed Training Ration	
	Components	Substitutes	Components	Substitutes	Components	Substitutes on Basis of Energy
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.
Butter	0.25		0.47		0.5	
Oleomargarine		0.25	0.11		0.5	
Total butter, etc.	0.25	0.25	0.58		1.0	
Total butter, etc.	0.50		0.58		1.0	
Sirup	1.75[3]		0.70		1.00	
Flavoring extract	0.014				0.014	
ENERGY SUPPLIED Calories	4859		3504[6]		4132	
% DISTRIBUTION OF Calories	P. 12.5	F. 33.3 C. 54.2	P. 13.8	F. 31.4 C.[8] 54.8	P. 12.6	F. 30.3 C. 57.1
[7]Canteen Cost based on Q. M. prices March, 1919	51.90¢		13.2	31.2 55.6	48.64¢	

[1] One two-pound loaf for each three men.
[2] These figures are based on 227 messes.
[3] Based on 4% fat.
[4] Equivalent to 0.16 gill.
[5] Equivalent to 0.32 gill.
[6] 3504 calories were supplied by articles enumerated above. In addition small quantities of a large variety of other foods were also used so that the total energy supplied amounted to 3900 calories. The percentage distribution of nutrients given is based on the food actually supplied by the messes.—(Calculations) F. H. S., 2–31–19.
[7] By addition of the average daily purchase from the canteen this distribution becomes: 13.2% P.; 31.2% F.; and 55.6% C. H.

inadequate amount of milk, butter and sugar.

This new ration which it is proposed should be called the "training ration" presents the following advantages: (1) as regards the chief components it is approximately what the soldier has selected during the period of training for overseas service: It is, therefore, a ration *which can be eaten* and which can be issued in kind, and which, if issued in kind, would satisfy the appetite. (2) It would compel organizations to secure their luxuries by exercising more rigid economy. This would result in increased efficiency of the mess and consequently increased conservation of food. (3) A satisfactory distribution of nutrients is guaranteed. There would, therefore, be no need of outside purchases of food. Consequently, (4), all purchases could be centralized in the hands of the quartermaster and this itself would result in greater saving to the government.*

That the United States has been generous, not to say extravagant, in the supply of foods for the soldier in training is clearly shown in the accompanying table comparing the rations of the different Allied armies. It will be seen also that the proposed training ration, while effecting a saving of 10 per cent over the existing garrison ration, still provides 12 per cent more than the ration used by any other army during the period of training. The same can be said also for the field rations. The improved field ration

* This change has recently been authorized by changes in Army Regulations No. 83 effective April 1, 1919. The savings privilege has also been abrogated—all unused credits on account of rations reverting to the government.

TABLE V.

TRAINING RATIONS.

Ration	Protein	Fat	Carbohyd.	Protein	Fat	Carbohyd.	Total	Protein	Fat	Carbohyd.
	Gm.	Gm.	Gm.	Cal.	Cal.	Cal.	Cal.	%	%	%
British Home: May, 1918	124	136	419	507	1268	1708	3483	14.6	36.4	49
Canadian Training: Sheet No. 40. July 23, 1918	107	118	344	439	1097	1410	2946	14.9	37.2	47.9
French Normal: March 29, 1918	138	98	407	566	911	1915*	3604	15.7	25.3	59.0
Italian Territorial: Feb. 1, 1917	127	38	469	521	353	1923	2797	18.6	12.6	68.8
U. S. Garrison: A. R. 1221, July 16, 1918	147	174	643	605	1619	2635	4859	12.5	33.3	54.2
U. S. Training Ration: (proposed)	127	135	375	520	1254	2358	4132	12.6	30.3	57.1

* Includes 250 cc. wine equals 212 calories.

FIELD RATIONS.

Ration	Weight			Fuel Value			Total	Distribution		
	Protein	Fat	Carby.	Protein	Fat	Carby.		Protein	Fat	Carby.
	Gm.	Gm.	Gm.	Cal.	Cal.	Cal.	Cal.	%	%	%
British Field: May, 1918	156	153	441	640	1423	1808	3871	16.5	36.8	46.7
British Field and Trench: May, 1918	157	166	485	644	1544	1989	4177	15.4	37.0	47.6
French Strong: March 29, 1918	150	105	509	615	977	2407*	3999	15.4	24.4	60.2
Italian Combating: Feb. 1, 1917	131	45	535	535	419	2190	3329†	16.9	13.4	69.7
U. S. Trench, adopted Nov. 1, 1918: (Garrison and additions) Nov. 1 to March 31 incl.	162	209	594	664	1943	2435	5042	13.1	38.6	48.3
Apr. 1 to Oct. 31 incl.	145	175	594	594	1627	2435	4656	12.8	34.9	52.3

* Includes 375 cc. wine equals 320 calories.
† Includes wine equivalent to 179 calories.

adopted November 1, 1918 for the American Expeditionary Force is considerably larger than that of any other army of the Allies.

It was in this pleasant James McConnell Memorial Hospital at Farm Life School, Moore Co., N. C., that the afternoon session of the State Health Officers' Association was held on April 14. It is a bright, sunny spot, with inviting outlooks, certainly conducive to speedy convalescence and recovery.

APPENDIX IId.

Executive Summary: Diet and Health, National Academy Press, 1989

This document can be found in the pocket at the back of the report.

APPENDIX IIe.

Summary and Recommendations: The Surgeon General's Report on NUTRITION AND HEALTH 1988

The Surgeon General's Report on NUTRITION AND HEALTH

1988

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
DHHS (PHS) Publication No. 88-50210

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Summary and Recommendations

This Report addresses the substantial impact of daily dietary patterns on the health of Americans. Good health does not always come easily. It is the product of complex interactions among environmental, behavioral, social, and genetic factors. Some of these are, for practical purposes, beyond personal control. But there are many ways in which each of us can influence our chances for good health through the daily choices we make.

In recent years, scientific investigations have produced abundant information on the ways personal behavior affects health. This information can help us decide whether to smoke, when and how much to drink, how far to walk or climb stairs, whether to wear seat belts, and how or whether to engage in any other activity that might alter the risk of incurring disease or disability. For the two out of three adult Americans who do not smoke and do not drink excessively, one personal choice seems to influence long-term health prospects more than any other: what we eat.

Food sustains us, it can be a source of considerable pleasure, it is a reflection of our rich social fabric and cultural heritage, it adds valued dimensions to our lives. Yet what we eat may affect our risk for several of the leading causes of death for Americans, notably, coronary heart disease, stroke, atherosclerosis, diabetes, and some types of cancer. These disorders together now account for more than two-thirds of all deaths in the United States.

Undernutrition remains a problem in several parts of the world, as well as for certain Americans. But for most of us the more likely problem has become one of overeating—too many calories for our activity levels and an imbalance in the nutrients consumed along with them. Although much is still uncertain about how dietary patterns protect or injure human health, enough has been learned about the overall health impact of the dietary patterns now prevalent in our society to recommend significant changes in those patterns.

This first *Surgeon General's Report on Nutrition and Health* offers comprehensive documentation of the scientific basis for the recommended dietary changes. Through the extensive review contained in its chapters, the Report examines in detail current knowledge about the relationships among specific dietary practices and specific disease conditions and sum-

marizes the implications of this information for individual food choices, public health policy initiatives, and further research. The Report's main conclusion is that overconsumption of certain dietary components is now a major concern for Americans. While many food factors are involved, chief among them is the disproportionate consumption of foods high in fats, often at the expense of foods high in complex carbohydrates and fiber that may be more conducive to health. A list of the key recommendations based on the evidence presented in the Report is provided in Table 1.

Magnitude of the Problem

Diet has always had a vital influence on health. Until as recently as the 1940's, diseases such as rickets, pellagra, scurvy, beriberi, xerophthalmia, and goiter (caused by lack of adequate dietary vitamin D, niacin, vitamin C, thiamin, vitamin A, and iodine, respectively) were prevalent in this country and throughout the world. Today, thanks to an abundant food supply, fortification of some foods with critical trace nutrients, and better methods for determining and improving the nutrient content of foods, such "deficiency" diseases have been virtually eliminated in developed countries. For example, the introduction of iodized salt in the 1920's contributed greatly to eliminating iodine-deficiency goiter as a public health problem in the United States. Similarly, pellagra disappeared subsequent to the discovery of the dietary causes of this disease. Nutrient deficiencies are reported rarely in the United States, and the few cases of protein-energy malnutrition that are listed annually as causes of death generally occur as a secondary result of severe illness or injury, child neglect, the problems of the house-bound aged, premature birth, alcoholism, or some combination of these factors.

As the diseases of nutritional deficiency have diminished, they have been replaced by diseases of dietary excess and imbalance—problems that now rank among the leading causes of illness and death in the United States, touch the lives of most Americans, and generate substantial health care costs. Table 2, for example, lists the 10 leading causes of death in the United States in 1987.

In addition to the five of these causes that scientific studies have associated with diet (coronary heart disease, some types of cancer, stroke, diabetes mellitus, and atherosclerosis), another three—cirrhosis of the liver, accidents, and suicides—have been associated with excessive alcohol intake.

Table 1
Recommendations

Issues for Most People:

- *Fats and cholesterol:* Reduce consumption of fat (especially saturated fat) and cholesterol. Choose foods relatively low in these substances, such as vegetables, fruits, whole grain foods, fish, poultry, lean meats, and low-fat dairy products. Use food preparation methods that add little or no fat.

- *Energy and weight control:* Achieve and maintain a desirable body weight. To do so, choose a dietary pattern in which energy (caloric) intake is consistent with energy expenditure. To reduce energy intake, limit consumption of foods relatively high in calories, fats, and sugars, and minimize alcohol consumption. Increase energy expenditure through regular and sustained physical activity.

- *Complex carbohydrates and fiber:* Increase consumption of whole grain foods and cereal products, vegetables (including dried beans and peas), and fruits.

- *Sodium:* Reduce intake of sodium by choosing foods relatively low in sodium and limiting the amount of salt added in food preparation and at the table.

- *Alcohol:* To reduce the risk for chronic disease, take alcohol only in moderation (no more than two drinks a day), if at all. Avoid drinking any alcohol before or while driving, operating machinery, taking medications, or engaging in any other activity requiring judgment. Avoid drinking alcohol while pregnant.

Other Issues for Some People:

- *Fluoride:* Community water systems should contain fluoride at optimal levels for prevention of tooth decay. If such water is not available, use other appropriate sources of fluoride.

- *Sugars:* Those who are particularly vulnerable to dental caries (cavities), especially children, should limit their consumption and frequency of use of foods high in sugars.

- *Calcium:* Adolescent girls and adult women should increase consumption of foods high in calcium, including low-fat dairy products.

- *Iron:* Children, adolescents, and women of childbearing age should be sure to consume foods that are good sources of iron, such as lean meats, fish, certain beans, and iron-enriched cereals and whole grain products. This issue is of special concern for low-income families.

Table 2
Estimated Total Deaths and Percent of Total Deaths for the 10 Leading Causes of Death: United States, 1987

Rank	Cause of Death	Number	Percent of Total Deaths
1[a]	Heart diseases	759,400	35.7
	(Coronary heart disease)	(511,700)	(24.1)
	(Other heart disease)	(247,700)	(11.6)
2[a]	Cancers	476,700	22.4
3[a]	Strokes	148,700	7.0
4[b]	Unintentional injuries	92,500	4.4
	(Motor vehicle)	(46,800)	(2.2)
	(All others)	(45,700)	(2.2)
5	Chronic obstructive lung diseases	78,000	3.7
6	Pneumonia and influenza	68,600	3.2
7[a]	Diabetes mellitus	37,800	1.8
8[b]	Suicide	29,600	1.4
9[b]	Chronic liver disease and cirrhosis	26,000	1.2
10[a]	Atherosclerosis	23,100	1.1
. . .	All causes	2,125,100	100.0

[a]Causes of death in which diet plays a part.
[b]Causes of death in which excessive alcohol consumption plays a part.

Source: National Center for Health Statistics, *Monthly Vital Statistics Report*, vol. 37, no. 1, April 25, stics Report, vol. 37, no. 1, April 25, 1988.

Although the precise proportion attributable to diet is uncertain, these eight conditions accounted for nearly 1.5 million of the 2.1 million total deaths in 1987. Dietary excesses or imbalances also contribute to other problems such as high blood pressure, obesity, dental diseases, osteoporosis, and gastrointestinal diseases. Together, these diet-related conditions inflict a substantial burden of illness on Americans. For example:

- *Coronary Heart Disease*. Despite the recent sharp decline in the death rate from this condition, coronary heart disease still accounts for the largest number of deaths in the United States. More than 1.25 million heart attacks occur each year (two-thirds of them in men), and more than 500,000 people die as a result. In 1985, illness and deaths from coronary heart disease cost Americans an estimated $49 billion in direct health care expenditures and lost productivity.
- *Stroke*. Strokes occur in about 500,000 persons per year in the United States, resulting in nearly 150,000 deaths in 1987 and long-term disability for many individuals. Approximately 2 million living Americans suffer from stroke-related disabilities, at an estimated annual cost of more than $11 billion.

- *High Blood Pressure.* High blood pressure (hypertension) is a major risk factor for both heart disease and stroke. Almost 58 million people in the United States have hypertension, including 39 million who are under age 65. The occurrence of hypertension increases with age and is higher for black Americans (of which 38 percent are hypertensive) than for white Americans (29 percent).
- *Cancer.* More than 475,000 persons died of cancer in the United States in 1987, making it the second leading cause of death in this country. During the same period, more than 900,000 new cases of cancer occurred. The costs of cancer for 1985 have been estimated to be $22 billion for direct health care, $9 billion in lost productivity due to treatment or disability, and $41 billion in lost productivity due to premature mortality, for a total cost of $72 billion.
- *Diabetes Mellitus.* Approximately 11 million Americans have diabetes, but almost half of them have not been diagnosed. In addition to the nearly 38,000 deaths in 1987 attributed directly to this condition, diabetes also contributes to an estimated 95,000 deaths per year from associated cardiovascular and kidney complications. In 1985, diabetes was estimated to cost $13.8 billion per year, or about 3.6 percent of total health care expenses.
- *Obesity.* Obesity affects approximately 34 million adults ages 20 to 74 years in the United States, with the highest rates observed among the poor and minority groups. Obesity is a risk factor for coronary heart disease, high blood pressure, diabetes, and possibly some types of cancer as well as other chronic diseases.
- *Osteoporosis.* Approximately 15 to 20 million Americans are affected by osteoporosis, which contributes to some 1.3 million bone fractures per year in persons 45 years and older. One-third of women 65 years and older have vertebral fractures. On the basis of x-ray evidence, by age 90 one-third of women and one-sixth of men will have suffered hip fractures, leading to death in 12 to 20 percent of those cases and to long-term nursing care for many who survive. The total costs of osteoporosis to the U.S. economy were estimated to be $7 to $10 billion in 1983.
- *Dental Diseases.* Dental caries and periodontal disease continue to affect a large proportion of Americans and cause substantial pain, restriction of activity, and work loss. Although dental caries among children, as well as some forms of adult periodontal disease, appear to be declining, the overall prevalence of these conditions imposes a substantial burden on Americans. The costs of dental care were estimated at $21.3 billion in 1985.

- *Diverticular Disease*. Because most persons with diverticular disease do not have symptoms, the true prevalence of this condition is unknown. Frequency increases with age, and up to 70 percent of people between the ages of 40 and 70 may be affected. In 1980, diverticulosis was accountable for some 200,000 hospitalizations.

In assessing the role that diet might play in prevention of these conditions, it must be understood that they are caused by a combination (and interaction) of multiple environmental, behavioral, social, and genetic factors. The exact proportion that can be attributed directly to diet is uncertain. Although some experts have suggested that dietary factors overall are responsible for perhaps a third or more of all cases of cancer, and similar estimates have been made for coronary heart disease, such suggestions are based on interpretations of research studies that cannot completely distinguish dietary from genetic, behavioral, or environmental causes.

We know, for example, that cigarette smoking exerts a powerful influence on the occurrence of both coronary heart disease and some types of cancer. We also know that some people are genetically predisposed to coronary heart disease, stroke, and diabetes and that the interaction of genetic predisposition with dietary patterns is an important determinant of individual risk. For these reasons, it is not yet possible to determine the proportion of chronic diseases that could be reduced by dietary changes. Nonetheless, it is now clear that diet contributes in substantial ways to the development of these diseases and that modification of diet can contribute to their prevention. The magnitude of the health and economic cost of diet-related disease suggests the importance of the dietary changes suggested. This Report reviews these issues in detail.

Nature of the Evidence

Whereas centuries of clinical observations and decades of basic and clinical research prove that dietary deficiencies of single, identifiable nutrients can cause disease, research on the relationship of dietary excesses and imbalances to chronic disease yields results that rarely provide such direct proof of causality. Instead, investigators must piece together various kinds of information from several kinds of sources. Nevertheless, the quantity of current animal, laboratory, clinical, and epidemiologic evidence that associates dietary excesses and imbalances with chronic disease is substantial and, when evaluated according to established principles, compelling.

Scientists must often draw inferences about the relationships between dietary factors and disease from laboratory animal studies or human meta-

bolic and population studies that approach the issues indirectly. Data sources for such human studies include clinical and laboratory measurements of physiologic indicators of nutritional status or risk factors, as well as dietary intake data estimated for populations or individuals. Epidemiologic studies using these data compare dietary intake and disease rates in different countries or in defined groups within the same country.

Interpretations of animal studies are limited by uncertainties about their applicability to people. Clinical, laboratory, and dietary intake studies can provide useful information, but each has limitations. Currently available clinical and laboratory measurements reveal only a small part of the complex physiological responses to diet, and they may reflect past rather than current nutritional status. Dietary surveys depend on accurate recall of the types and portion sizes of consumed foods as well as on the assumption that the food intake during any one period represents typical intake. Reported intake, however, is not always accurate, and intake reported for a given period may differ significantly from that typical of longer time periods. Dietary intake data provide useful indicators for populations, but even when an association or correlation between a dietary factor and a disease is observed, it is often difficult to prove that the dietary factor is an actual or sole cause of that disease.

This difference between association and causation is basic to understanding the scientific evidence that links diet to chronic disease. Uncertainties in the ability to determine causation have sometimes made it difficult to achieve consensus on appropriate public health nutrition policies. Established principles require evaluation of the supporting evidence for a given association between a dietary factor and a disease on the basis of its consistency, strength, specificity, and biological plausibility. The evidence showing that dietary intake of saturated fat raises blood cholesterol, which in turn increases the chance of coronary heart disease, illustrates this point. The similarity in results from laboratory, clinical, and epidemiologic research, the apparent relationship between dose and effect in these studies, the observations that the increase in blood cholesterol level is specific to saturated fatty acids but not to other types, and the biological plausibility of explanations for the observations, when taken together, provide considerable support for concluding that the association is causal, at least for some individuals.

For some of the other diseases reviewed in this Report, the available evidence is less complete and less consistent. Nevertheless, much evidence supports credible associations between a dietary pattern of excesses

and imbalances and several important chronic diseases. These associations, in turn, suggest that the overall health of Americans could be improved by a few specific but fundamental dietary changes.

Key Findings and Recommendations

Even though the results of various individual studies may be inconclusive, the preponderance of the evidence presented in the Report's comprehensive scientific review substantiates an association between dietary factors and rates of chronic diseases. In particular, the evidence suggests strongly that a dietary pattern that contains excessive intake of foods high in calories, fat (especially saturated fat), cholesterol, and sodium, but that is low in complex carbohydrates and fiber, is one that contributes significantly to the high rates of major chronic diseases among Americans. It also suggests that reversing such dietary patterns should lead to a reduced incidence of these chronic diseases.

This *Surgeon General's Report on Nutrition and Health* provides a comprehensive review of the most important scientific evidence in support of current Federal nutrition policy as stated in the *Dietary Guidelines for Americans*. These *Guidelines*, issued jointly by the Department of Agriculture and the Department of Health and Human Services, recommend:

- Eat a variety of foods.
- Maintain desirable weight.
- Avoid too much fat, saturated fat, and cholesterol.
- Eat foods with adequate starch and fiber.
- Avoid too much sugar.
- Avoid too much sodium.
- If you drink alcoholic beverages, do so in moderation.

Evidence presented in this Report expands the focus of these seven guidelines and provides considerable insight into priorities. Clearly emerging as the primary priority for dietary change is the recommendation to reduce intake of total fats, especially saturated fat, because of their relationship to development of several important chronic disease conditions. Because excess body weight is a risk factor for several chronic diseases, maintenance of desirable weight is also an important public health priority. Evidence further supports the recommendation to consume a dietary pattern that contains a variety of foods, provided that these foods are generally low in calories, fat, saturated fat, cholesterol, and sodium.

Taken together, the recommendations in this Report promote a dietary pattern that emphasizes consumption of vegetables, fruits, and whole grain products—foods that are rich in complex carbohydrates and fiber and relatively low in calories—and of fish, poultry prepared without skin, lean meats, and low-fat dairy products selected to minimize consumption of total fat, saturated fat, and cholesterol.

The evidence presented in this Report suggests that such overall dietary changes will lead to substantial improvements in the nutritional quality of the American diet. Consuming a higher proportion of calories from fruits, vegetables, and grains may lead to a modest reduction in protein intake for some people, but this reduction is unlikely to impair nutritional status. Average levels of protein consumption in the United States, 60 grams per day for women and 90 grams per day for men, are well above the National Research Council's recommendations of 44 and 56 grams per day, respectively.

The evidence also suggests that most Americans generally need not consume nutrient supplements. An estimated 40 percent of Americans consume supplemental vitamins, minerals, or other dietary components at an annual cost of more than $2.7 billion. Although nutrient supplements are usually safe in amounts corresponding to the Recommended Dietary Allowances (and such Allowances are set to ensure that the nutrient needs of practically all the population are met), there are no known advantages to healthy people consuming excess amounts of any nutrient, and amounts greatly exceeding recommended levels can be harmful. For example, some nutrients such as selenium have a narrow range of safe level of intake. Toxicity has been reported for most minerals and trace elements, as well as some vitamins, indicating that excessive supplementation with these substances can be hazardous.

Finally, some recommendations for dietary change apply broadly to the general public whereas others apply only to specific population groups. These major findings and recommendations of *The Surgeon General's Report on Nutrition and Health* are noted below.

Issues for Most People

- *Fats and cholesterol:* Reduce consumption of fat (especially saturated fat) and cholesterol. Choose foods relatively low in these substances, such as vegetables, fruits, whole grain foods, fish, poultry, lean meats, and low-fat dairy products. Use food preparation methods that add little or no fat.

High intake of total dietary fat is associated with increased risk for obesity, some types of cancer, and possibly gallbladder disease. Epidemiologic, clinical, and animal studies provide strong and consistent evidence for the relationship between saturated fat intake, high blood cholesterol, and increased risk for coronary heart disease. Conversely, reducing blood cholesterol levels reduces the risk for death from coronary heart disease. Excessive saturated fat consumption is the major dietary contributor to total blood cholesterol levels. Dietary cholesterol raises blood cholesterol levels, but the effect is less pronounced than that of saturated fat. While polyunsaturated fatty acid consumption, and probably monounsaturated fatty acid consumption, lowers total blood cholesterol, the precise effects of specific fatty acids are not well defined.

Dietary fat contributes more than twice as many calories as equal quantities (by weight) of either protein or carbohydrate, and some studies indicate that diets high in total fat are associated with higher obesity rates. In addition, there is substantial, although not yet conclusive, epidemiologic and animal evidence in support of an association between dietary fat intake and increased risk for cancer, especially breast and colon cancer. Similarly, epidemiologic studies suggest an association between gallbladder disease, excess caloric intake, high dietary fat, and obesity. More precise conclusions about the role of dietary fat await the development of improved methods to distinguish among the contributions of the high-calorie, high-fat, and low-fiber components of current American dietary patterns.

At present, dietary fat accounts for about 37 percent of the total energy intake of Americans—well above the upper limit of 30 percent recommended by the American Heart Association and the American Cancer Society, and above the p· ·cent consumed by many societies, such as Mediterranean countries, _pan, and China, for example, where coronary heart disease rates are much lower than those observed in the United States. Consumption of saturated fat and cholesterol is also substantially higher among many Americans than levels recommended by several expert groups.

The major dietary sources of fat in the American diet are meat, poultry, fish, dairy products, and fats and oils. Animal products tend to be higher in both total and saturated fats than most plant sources. Although some plant fats such as coconut and palm kernel oils also contain high proportions of saturated fatty acids, these make minor contributions to total intake of saturated fats in the United States. Dietary cholesterol is found only in foods of animal origin, such as eggs, meat, poultry, fish, and dairy prod-

ucts. To help reduce consumption of total fat, especially saturated fat and cholesterol, food choices should emphasize intake of fruits, vegetables, and whole grain products and cereals. They should also emphasize consumption of fish, poultry prepared without skin, lean meats, and low-fat dairy products. Among vegetable fats, those that are more unsaturated are better choices.

- *Energy and weight control:* **Achieve and maintain a desirable body weight. To do so, choose a dietary pattern in which energy (caloric) intake is consistent with energy expenditure. To reduce energy intake, limit consumption of foods relatively high in calories, fats, and sugars and minimize alcohol consumption. Increase energy expenditure through regular and sustained physical activity.**

People are considered overweight if their body mass index, or BMI (a ratio of weight to height described in the Report), exceeds the 85th percentile for young American adults (approximately 120 percent of desirable body weight); they are considered severely overweight if their BMI exceeds the 95th percentile (approximately 140 percent of desirable body weight). Overweight individuals are at increased risk for diabetes mellitus, high blood pressure and stroke, coronary heart disease, some types of cancer, and gallbladder disease. Epidemiologic and animal studies have shown consistently that overall risk for death is increased with excess weight, with risk increasing as severity of obesity increases.

Type II (noninsulin-dependent) diabetes mellitus accounts for approximately 90 percent of all cases of diabetes and is strongly associated with obesity. Clinical studies indicate that weight loss can improve control of Type II diabetes.

Obesity increases the risk for high blood pressure, and consequently for stroke; it also increases blood cholesterol levels associated with coronary heart disease. In addition, it appears to be an independent risk factor for coronary heart disease. Weight reduction has been shown to reduce high blood pressure and high blood cholesterol. Most obese individuals who achieve a more desirable body weight improve their cholesterol profile, achieving a decrease in both total blood cholesterol and LDL (low density lipoprotein) cholesterol.

Some studies have found an association between overweight and increased risk for several cancers, especially cancer of the uterus and breast. In addition, overweight increases the risk for gallbladder disease.

More than a quarter of American adults are overweight. Black women age 45 and above have the highest prevalence, about 60 percent. Although evidence suggests a genetic component to the tendency of many people to become overweight, patterns of dietary caloric intake and energy expenditure play a key role. Sustained and long-term efforts to reduce body weight can best be achieved as a result of improving energy balance by reducing energy consumption and raising energy expenditure through physical activity and exercise.

Maintenance of desirable body weight throughout the lifespan requires a balance between energy (calorie) intake and expenditure. Weight control may be facilitated by decreasing energy intake, especially by choosing foods relatively low in calories, fats, and sugars, and by minimizing alcohol consumption. Energy expenditure can be enhanced through regular physical activities such as daily walks or by jogging, bicycling, or swimming at least three times a week for at least 20 minutes.

- ***Complex carbohydrates and fiber*: Increase consumption of whole grain foods and cereal products, vegetables (including dried beans and peas), and fruits.**

Dietary patterns emphasizing foods high in complex carbohydrates and fiber are associated with lower rates of diverticulosis and some types of cancer. The association shown in epidemiologic and animal studies between diets high in complex carbohydrates and reduced risk for coronary heart disease and diabetes mellitus is, however, difficult to interpret. The fact that such diets tend also to be lower in energy and fats, especially saturated fat and cholesterol, clearly contributes to this difficulty. Some evidence from clinical studies also suggests that water-soluble fibers from foods such as oat bran, beans, or certain fruits are associated with lower blood glucose and blood lipid levels. Consuming foods with dietary fiber is usually beneficial in the management of constipation and diverticular disease.

While inconclusive, some evidence also suggests that an overall increase in intake of foods high in fiber might decrease the risk for colon cancer. Among several unresolved issues is the role of the various types of fiber, which differ in their effects on water-holding capacity, viscosity, bacterial fermentation, and intestinal transit time.

Other food components associated with decreased cancer risk are commonly found in diets high in whole grain cereal products containing complex carbohydrates and fiber. In addition, some epidemiologic evidence

suggests that frequent consumption of vegetables and fruits, particularly dark green and deep yellow vegetables and cruciferous vegetables (such as cabbage and broccoli), may lower risk for cancers of the lung and bladder as well as some cancers of the alimentary tract. However, the specific components in these foods that may have protective effects have not yet been established. Current evidence suggests the prudence of increasing consumption of whole grain foods and cereals, vegetables (including dried beans and peas), and fruits.

- ***Sodium:*** **Reduce intake of sodium by choosing foods relatively low in sodium and limiting the amount of salt added in food preparation and at the table.**

Studies indicate a relationship between a high sodium intake and the occurrence of high blood pressure and stroke. Salt contains about 40 percent sodium by weight and is used widely in the preservation, processing, and preparation of foods. Although sodium is necessary for normal metabolic function, it is consumed in the United States at levels far beyond the 1.1 to 3.3 grams per day found to be as safe and adequate for adults by the National Research Council. Average current sodium intake for adults in the United States is in the range of 4 to 6 grams per day.

Blacks and persons with a family history of high blood pressure are at greater risk for this condition. While some people maintain normal blood pressure levels over a wide range of sodium intake, others appear to be "salt sensitive" and display increased blood pressure in response to high sodium intakes.

Although not all individuals are equally susceptible to the effects of sodium, several observations suggest that it would be prudent for most Americans to reduce sodium intake. These include the lack of a practical biological marker for individual sodium sensitivity, the benefit to persons whose blood pressures do rise with sodium intake, and the lack of harm from moderate sodium restriction.

Processed foods provide about a third or more of dietary sodium. Because about another third of the sodium consumed by Americans is added by the consumer, much can be done to reduce sodium consumption by using less salt at the table and substituting alternative flavoring such as herbs, spices, and lemon juice in the preparation of foods. In addition, choices can be made of foods modified to lower sodium content and less frequent choices could be made of foods to which sodium is added in processing and preservation.

- *Alcohol:* **To reduce the risk for chronic disease, take alcohol only in moderation (no more than two drinks a day), if at all. Avoid drinking any alcohol before or while driving, operating machinery, taking medications, or engaging in any other activity requiring judgment. Avoid drinking alcohol while pregnant.**

Alcohol is a drug that can produce addiction in susceptible individuals, birth defects in some children born to mothers who drink alcohol during pregnancy, impaired judgment, impaired ability to drive automobiles or operate machinery, and adverse reactions in people taking certain medications. In addition, alcohol abuse has been associated with disrupted family functioning, suicides, and homicides.

Excessive use of alcohol is also associated with liver disease, some types of cancer, high blood pressure, stroke, and disorders of the heart muscle. Extensive epidemiologic and clinical evidence has identified alcohol consumption as the principal cause of liver cirrhosis in the United States, at least in part as a result of the direct toxic effects of alcohol on the liver. Smoking and alcohol appear to act synergistically to increase the risk for cancers of the mouth, larynx, and esophagus. Less conclusive and somewhat conflicting evidence suggests a role of alcohol in other types of cancers such as those of the liver, rectum, breast, and pancreas.

Studies indicate a direct association between increased blood pressure and the consumption of alcohol at levels beyond about two drinks[a] daily. Extremely excessive alcohol consumption is associated with cardiomyopathy. Alcohol consumption by the mother during pregnancy has also been associated with fetal malformations.

Although consumption of up to two drinks per day has not been associated with disease among healthy men and nonpregnant women, surveys suggest that at least 9 percent of the total population consumes two or more drinks per day and those in this group need to reduce their alcohol consumption. A threshold level of safety for alcohol intake during pregnancy has not been established. Thus, pregnant women and women who may become pregnant should avoid drinking alcohol.

[a]One drink is defined as a 12 ounce beer, a 5 ounce glass of wine, or 1½ fluid ounces (one jigger) of distilled spirits, each of which contains about 1 ounce of alcohol.

Other Issues for Some People

- ***Fluoride:*** **Community water systems should contain fluoride at optimal levels for prevention of tooth decay. If such water is not available, use other appropriate sources of fluoride.**

The most efficient means of making fluoride available to the general public to reduce dental disease is through drinking water. Numerous epidemiologic and clinical studies have attested to the efficacy, safety and cost-effectiveness of systemic fluoride in the prevention of tooth decay. Lifetime use of water containing an optimal fluoride concentration of approximately 1 part per million has been shown to reduce the prevalence of dental caries by more than 50 percent. Water fluoridation is considered one of the most successful public health efforts introduced in the United States.

For children living in areas with inadequate concentrations of fluoride in the water, supplementary fluoride sources should be used at dosages that depend on the fluoride content of the local water supply and the age of the child. The effectiveness of prenatal fluoride administration, however, is uncertain because clinical studies of its effects on subsequent caries incidence have been equivocal. Excessive fluoride should be avoided because it may cause mottling of developing teeth.

- ***Sugars:*** **Those who are particularly vulnerable to dental caries (cavities), especially children, should limit their consumption and frequency of use of foods high in sugars.**

Although genetic, behavioral, and other dietary factors also influence dental health, the major role of sugars in promotion of tooth decay is well established from animal, epidemiologic, clinical, and biochemical studies. Newly erupting teeth are generally more vulnerable to decay than mature teeth.

Research has shown that three conditions must exist for the formation of dental caries: the presence of fermentable carbohydrate, acid-producing bacteria, and a susceptible tooth. Caries-producing bacteria metabolize a range of sugars (glucose, fructose, maltose, lactose, and sucrose) to acids that demineralize teeth. The unique role of sucrose (common table sugar) in dental caries is related to its special ability to be converted by these bacteria into long, complex molecules that adhere firmly to teeth and form plaque.

The most important diet-related interventions are fluoridation of drinking water, or the use of other means of fluoride administration, and control of intake of sugars. While fluoride is the most important factor overall in dental caries prevention, reduction in the frequency of consumption and in the quantity of sugar-rich foods in the diet will also help reduce decay. Sticky sweet foods that adhere to the teeth are more cariogenic than those that wash off quickly. The longer cariogenic foods remain in the mouth, the more they are likely to increase the initiation and progression of tooth decay.

- ***Calcium:* Adolescent girls and adult women should increase consumption of foods high in calcium, including low-fat dairy products.**

Inadequate dietary calcium consumption in the first three to four decades of life may be associated with increased risk for osteoporosis in later life. Osteoporosis, a chronic disease characterized by progressive loss of bone mass with aging, occurs in both women and men, although postmenopausal women are twice as likely as men to have severe osteoporosis with consequent bone fractures. Evidence shows that chronically low calcium intake, especially during adolescence and early adulthood, may compromise development of peak bone mass. In postmenopausal women, the group at highest risk for osteoporosis, estrogen replacement therapy under medical supervision is the most effective means to reduce the rate of bone loss and risk for fractures. Maintenance of adequate levels of physical activity and cessation of cigarette smoking have also been associated with reduced osteoporosis risk.

Although the precise relationship of dietary calcium to osteoporosis has not been elucidated, it appears that higher intakes of dietary calcium could increase peak bone mass during adolescence and delay the onset of bone fractures later in life. Thus, increased consumption of foods rich in calcium may be especially beneficial for adolescents and young women. Food sources of calcium consistent with other dietary recommendations in this Report include low-fat dairy products, some canned fish, certain vegetables, and some calcium-enriched grain products.

- ***Iron:* Children, adolescents, and women of childbearing age should be sure to consume foods that are good sources of iron, such as lean meats, fish, certain beans, and iron-enriched cereals and whole grain products. This issue is of special concern for low-income families.**

Dietary iron deficiency is responsible for the most prevalent form of anemia in the United States. Iron deficiency hampers the body's ability to produce hemoglobin, a substance needed to carry oxygen in the blood. A

principal consequence of iron deficiency is reduced work capacity, although depressed immune function, changes in behavior, and impaired intellectual performance may also result. Because of the serious consequences of iron deficiency, continual monitoring of the iron status of individuals at high risk—particularly children from low-income families, adolescents, and women of childbearing age—is vital, as is treatment of those identified to be iron deficient.

Proper infant feeding—preferably breastfeeding, otherwise use of iron-fortified formula—is the most important safeguard against iron deficiency in infants. Among adolescents and adults, iron intake can be improved by increasing consumption of iron-rich foods such as lean meats, fish, certain kinds of beans, and iron-enriched cereals and whole grain products. Also, consuming foods that contain vitamin C increases the likelihood that iron will be absorbed efficiently.

Policy Implications

Dietary Guidance

General Public

Educating the public about the dietary choices most conducive to prevention and control of certain chronic diseases is essential. Educational efforts should begin in primary school and continue throughout the secondary grades, and should focus on the dietary principles outlined in this Report—the potential health benefits of eating a diet that is lower in fat (especially saturated fat) and rich in complex carbohydrates and fiber. The importance of adequate physical activity should also be stressed. Efforts should continue throughout each stage of life to promote the principles outlined in the *Dietary Guidelines for Americans*.

Special Populations

A disproportionate burden of diet-related disease is borne by subgroups in our population. Black Americans, for example, have higher rates of high blood pressure, strokes, diabetes, and other diseases associated with obesity (but lower rates of osteoporosis) than the general population. Some groups of Native Americans exhibit the highest rates of diabetes in the world. Pregnant and lactating women also have special nutritional needs. Particular effort should be made to identify and remove the barriers to optimal health and nutritional status in such high-risk groups, using methods that take into consideration their diverse cultural backgrounds.

Many older persons suffer from chronic diseases that can reduce functional independence; many take multiple medications that may adversely interact with nutrients. Sound public education directed toward this group—and professional education directed toward individuals who care for older Americans—should focus on dietary means to reduce risk factors for chronic disease, to promote functional independence, and to prevent adverse consequences of use of medications.

Health Professionals

Improved nutrition training of physicians and other health professionals is needed. Training should emphasize basic principles of nutrition, the role of diet in health promotion and disease prevention, nutrition assessment methodologies and their interpretation, therapeutic aspects of dietary intervention, behavioral aspects of dietary counseling, and the role of dietitians and nutritionists in dietary counseling of patients.

Programs and Services

Food Labels

Food labeling offers opportunities to inform people about the nutrient content of foods so as to facilitate dietary choices most conducive to health. Food manufacturers should be encouraged to make full use of nutrition labels. Labels of processed foods should state the content of calories, protein, carbohydrate, fats, cholesterol, sodium, and vitamins and minerals. To the extent permitted by analytical methods, manufacturers should disclose information where appropriate on the content of saturated and unsaturated fatty acids and total fiber in foods that normally contain them. Descriptive terms such as "low calorie" and "sodium reduced" in compliance with the Food and Drug Administration's regulations for food labeling may also be helpful, and the expanded use of these terms should be encouraged.

Nutrition Services

Health care programs for individuals of all ages should include nutrition services such as, when appropriate, nutrition counseling for individuals or groups, interpretation and implementation of prescribed therapeutic diets tailored to individual food preferences and lifestyle, referral to appropriate community services and food assistance programs, monitoring of progress, and appropriate followup. These services should routinely incorporate assessment of nutritional status and needs based on established crite-

ria to identify individuals with nutritional risk factors who would profit from preventive measures and those with nutritional disorders who need remedial care.

Food Services

Lack of access to an appropriate diet should not be a health problem for any American. Wherever food is served to people or provided through food assistance programs, it should reflect the principles of good nutrition stated in this Report. Whether served in hospitals, schools, military installations, soup kitchens, day care centers, or nursing homes, or whether delivered to homes, food service programs offer important opportunities for improving health and providing dietary education. Such programs should pay special attention to the nutritional needs of older people, pregnant women, and children, especially those of low income or other special dietary needs. Because a large proportion of the population takes meals in restaurants and convenience food facilities, improvements in the overall nutritional balance of the meals served in such places can be expected to contribute to health benefits.

Food service programs should also take particular care to ensure that special diets lower in fat, especially saturated fat, are provided to people with elevated blood cholesterol, heart disease, or diabetes; that diets low in sodium are provided to individuals with high blood pressure; and that protein-restricted diets are made available to people with end-stage kidney disease.

Food Products

The public would benefit from increased availability of foods and food products low in calories, total fat, saturated fat, cholesterol, sodium, and sugars, but high in a variety of natural forms of fiber and, perhaps, certain minerals and vitamins. Food manufacturers can contribute to improving the quality of the American diet by increasing the availability of palatable, easily prepared food products that will help people to follow the dietary principles outlined here. Because the public is becoming increasingly conscious of the role of nutrition in health, development of such products should also benefit the food industry.

Research and Surveillance

Impressive evidence already links nutrition to chronic disease. However, much more information is needed to continue to identify changes in the

national diet that will lead to better health for the Nation. Gaps in our knowledge of nutrition suggest future research and surveillance needs. Examples are:

- The role of specific dietary factors in the etiology and prevention of chronic diseases.
- The childhood dietary pattern that will best prevent later development of chronic diseases.
- The effects of maternal nutrition on the health of the developing fetus.
- The nutrient and energy requirements of older adults.
- How nutrient requirements translate into healthful dietary patterns.
- The development of biochemical markers of dietary intake to monitor better the effects of dietary intervention.
- The identification of effective educational methods to translate dietary recommendations into appropriate food choices.
- The establishment of a nutrition surveillance system that will enhance the monitoring of population-specific and State-specific trends in the occurrence of nutrition-related risk factors and conditions.

APPENDIX IIf.

Background material: Presentation by Ms. Elena Carbone Britt:
Summary: The Year 2000 National Overview:
Health Objectives Summary

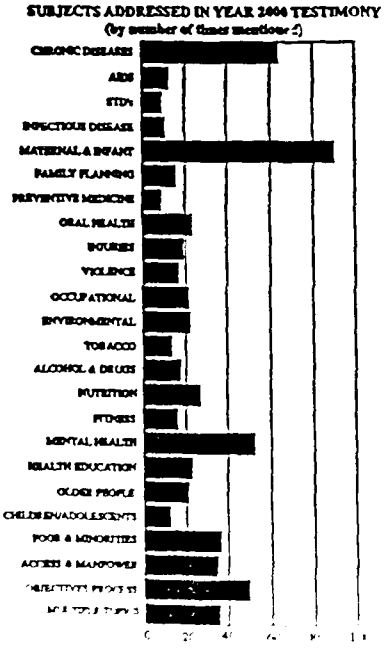
HEALTH FOR THE NATION

THE YEAR 2000 NATIONAL HEALTH OBJECTIVES

Year 2000 Priority Areas
(and lead agency)

Tobacco use (CDC)
Alcohol and other drug use (ADAMHA)
Nutrition (FDA/NIH)
Physical activity and fitness (PCPFS)
Mental health and mental illness (ADAMHA)
Environmental public health (NIH/CDC)
Occupational safety and health (CDC)
Unintentional injuries (CDC)
Violent and abusive behavior (CDC)
HIV infection and AIDS (NAPO)
Sexually transmitted diseases (CDC)
Infectious diseases (CDC)
Maternal and infant health (HRSA)
Oral health (CDC/NIH)
Adolescent pregnancy and reproductive health (OPA)
High blood cholesterol and high blood pressure (NIH)
Cancer (NIH)
Other chronic diseases and disorders (NIH/CDC)
Health and quality of life of older people (NIH)
Health education and access to preventive health services (CDC/ HRSA)
Surveillance and data systems (CDC)

ADAMHA-Alcohol, Drug Abuse, and Mental Health Administration; CDC-Centers for Disease Control; FDA-Food and Drug Administration; HRSA-Health Resources and Services Administration; NAPO-National AIDS Program Office; NIH-National Institutes of Health; OPA-Office of Population Affairs; PCPFS-President's Council on Physical Fitness and Sports



The U.S. Public Health Service (PHS) is coordinating the process of formulating the Year 2000 National Health Objectives. These national targets will focus on 21 priority areas which address leading health problems and risk factors, as well as other areas in which disease prevention and health promotion activities can help improve health status.

The project seeks to mobilize a broad range of groups and individuals within the health care system, in voluntary organizations, and in Federal, State, and local agencies in a coordinated prevention effort. The decade-long project will pursue precise, quantitative objectives for promoting health and reducing premature death, disease, and disability. It will also address the surveillance systems needed to assess problems and progress.

The year 2000 project builds upon the 1990 objectives effort, initiated in 1980, in several substantive ways. It expands the range of priorities into new areas, such as acquired immunodeficiency syndrome (AIDS), and expands the focus of others, such as high blood cholesterol and high blood pressure. The project targets populations which are at high risk and are especially hard to reach, and identifies settings, such as the workplace, which are conducive to a variety of disease prevention and health promotion interventions. There will be component objectives within each priority area which address the problems of particular groups such as Native Americans, blacks, Hispanics, and the elderly, and particular settings.

Equally important, greater emphasis will be given to planning effective implementation activities at the State and local level as well as on the Federal level. The PHS will encourage the development of specific activities designed by and for the various groups. As a result, the year 2000 initiative will provide new opportunities for more and different groups and individuals to participate in the national objectives effort.

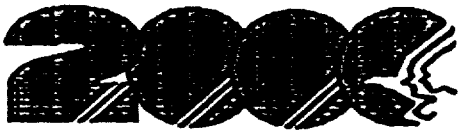
The comprehensive scope of the project requires careful development with broad input. The Institute of Medicine of the National Academy of Sciences is cooperating in the effort to elicit the opinions, expertise, and commitment of national professional and voluntary organizations, health care professionals, advocates, and consumers. These efforts began with regional public hearings held in 1987-1988 in Birmingham, Denver, Detroit, Houston, Los Angeles, New York, and Seattle. The hearings were intended to clarify health care problems and opportunities around the country and provide the PHS with a broad spectrum of detailed information about the special health care needs of local, racial, ethnic, and other special population groups in America. Additionally, 18 "mini-hearings" were held in conjunction with the national meetings of professional and voluntary organizations. This level of participation added a unique non-Federal perspective to the vast body of information generated by the hearings.

Using this input from over 700 individuals and groups, PHS agencies formed work groups to produce draft objectives for each of the 21 priority areas. Each work group will refer to several key publications. To ensure coordination among Federal, State, and local efforts on the objectives, each will include a representative from the Model Standards Coordinating Committee.

In December, preliminary drafts from each work group will be submitted to the Public Health Service's Steering Committee on the Year 2000 Objectives and to expert review panels for initial comment. The reviewed drafts will be forwarded to the Deputy Assistant Secretary for Health (Disease Prevention and Health Promotion) in February where they will be combined into a single draft document.

In June 1989, the draft objectives will be distributed to the 17-member Secretary's Council on Health Promotion and Disease Prevention. The draft objectives' availability for public comment will be announced in the *Federal Register*. Individuals and groups wishing to review the objectives at this time or participate in subsequent implementation may contact the ODPHP National Health Information Center to get on the June mailing list (see reverse).

After revision and a second and final review by the Secretary's Council, the year 2000 objectives will be published as the Surgeon General's second report on disease prevention and health promotion. Final publication is expected in the summer of 1990. The consistent policy direction of the two decade national objectives activity will strengthen efforts to improve the health of all Americans.



HEALTH FOR THE NATION

Year 2000 National Health Objectives - Priority Areas

HEALTH PROMOTION

1. **Nutrition**
2. **Physical Activity and Fitness**
3. **Tobacco**
4. **Alcohol and Other Drugs**
5. **Sexual Behavior**
6. **Violent and Abusive Behavior**
7. **Vitality and Independence of Older People**

HEALTH PROTECTION

8. **Environmental Health**
9. **Occupational Safety and Health**
10. **Unintentional Injuries**

PREVENTIVE SERVICES

11. **Maternal and Infant Health**
12. **Immunization and Infectious Diseases**
13. **HIV Infection**
14. **Sexually Transmitted Diseases**
15. **High Blood Cholesterol and High Blood Pressure**
16. **Cancer**
17. **Other Chronic Disorders**
18. **Oral Health**
19. **Mental and Behavioral Disorders**

SYSTEM IMPROVEMENT PRIORITIES

20. Health Education and Preventive Services
21. Surveillance and Data Systems

Grouping among categories is not intended to be exclusionary. There is overlap in the approaches embodied in the objectives of the various priority areas.

11/21/89

APPENDIX IIg.

Background Material from the Presentation: Implementation Strategies at a National Level

New FNB Study on Implementing Dietary Guidelines

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NATIONAL RESEARCH COUNCIL

COMMISSION ON LIFE SCIENCES

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FOOD AND NUTRITION BOARD

NEW FNB STUDY ON IMPLEMENTING DIETARY GUIDELINES

Background: There is a growing consensus among scientists and major health organizations about the nature of dietary modifications needed to promote health and lower the risk of specific diet-related chronic diseases. As a consequence, a number of governmental agencies and private health organizations have issued dietary guidelines for American consumers. Among them have been: US Departments of Agriculture and Health and Human Services; various institutes within the National Institutes of Health; voluntary health organizations, including the American Heart Association and the American Cancer Society; and the National Research Council of the National Academy of Sciences. However, efforts to implement dietary recommendations have been hampered by lack of a common strategy for the diverse segments of our society. Areas of conflicting interests have sometimes been emphasized at the expense of evolving a common policy that would reconcile such interests with improved public health. Public health agencies, legislators, and the food and agriculture industries are concerned about how best to implement dietary guidelines. For example, should the food supply be modified by educating the public, by legislative or regulatory measures, or by some combination of these actions?

If one of the national health objectives is to lower the risk of diet-related chronic diseases and if adoption of dietary guidelines is likely to help us attain that objective, then an implementation strategy is desirable.

New Study: The Food and Nutrition Board (FNB) of the National Research Council's Commission on Life Sciences is undertaking a project titled "Guidelines on Diet and Health: Implications and Strategies for Implementation." To guide the project, the FNB has established a study committee of some 20 professionals with expertise in agriculture, benefit-cost analysis, community nutrition intervention strategies, dietetics, epidemiology, food marketing, food production, food retail, food safety, mass media communication, medicine, medical science administration, nutrition science, preventive medicine, public health, public policy, risk benefit analysis, and social and behavioral psychology. The committee will designate separate task forces composed of committee members and outside experts, as needed, to develop goals, objectives, and an implementation strategy and options for groups such as the public sector, the private sector, educational and voluntary health organizations, and professionals in the nutrition, medical, and allied health fields.

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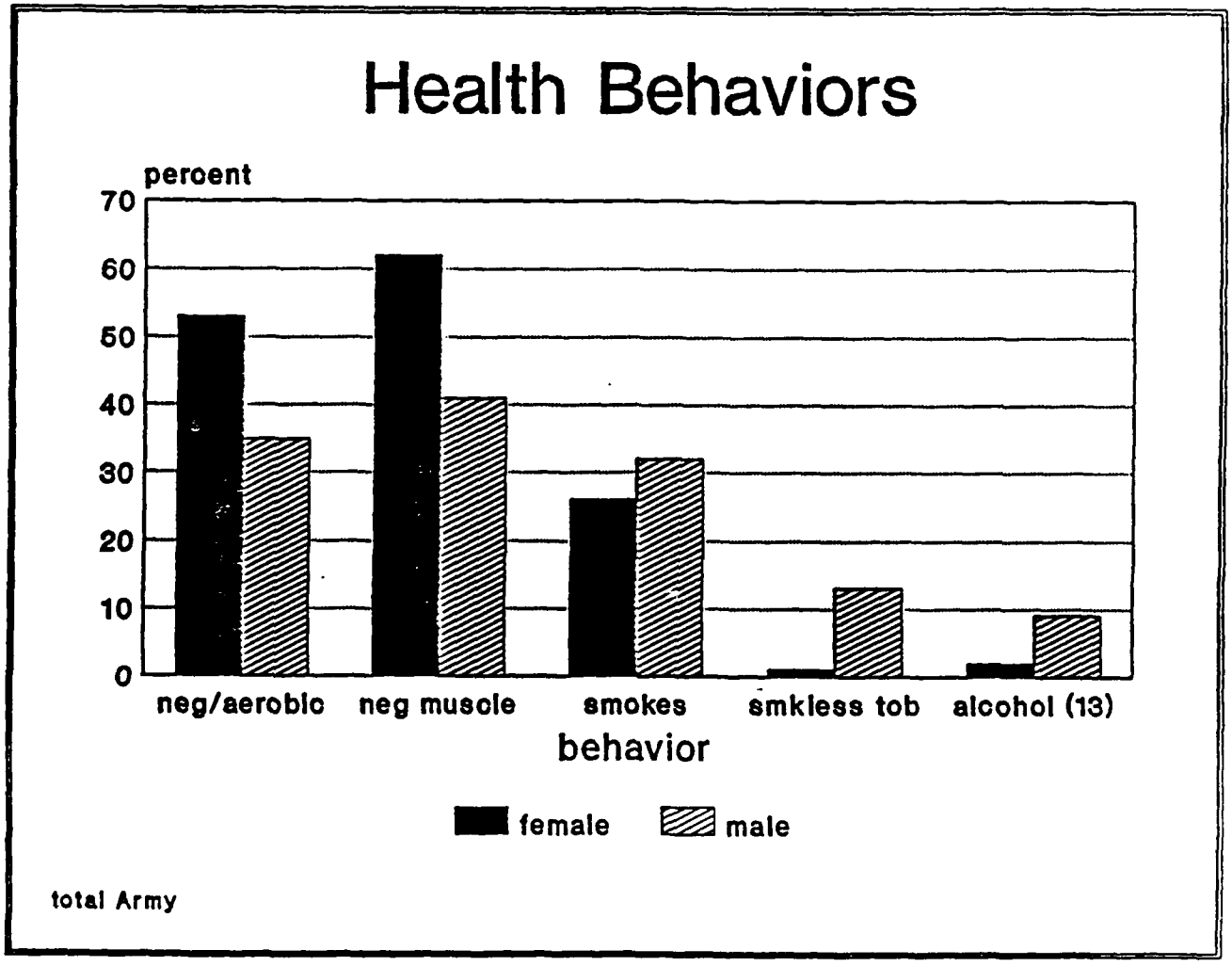
APPENDIX IIh.

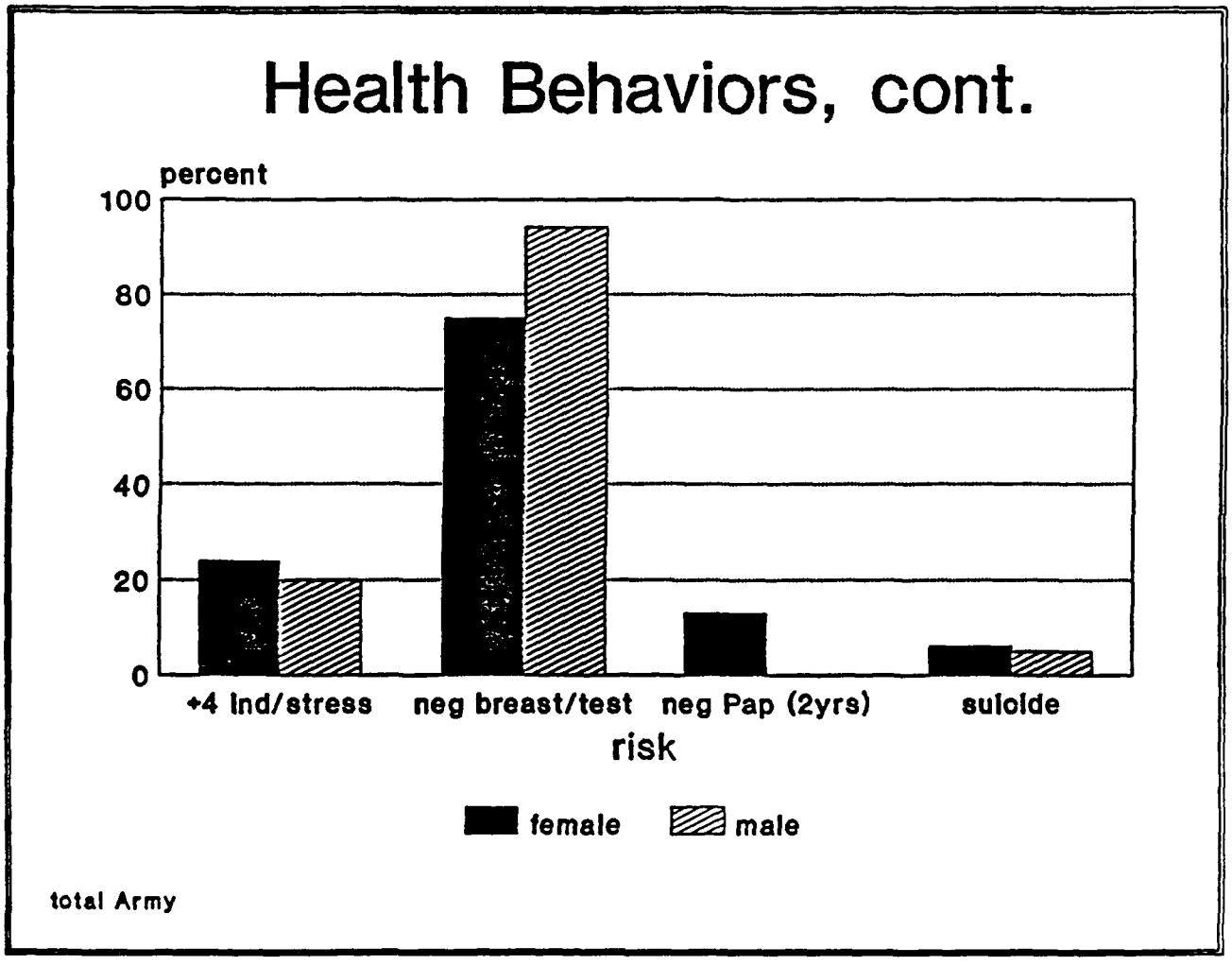
Presentation Graphics: "Where We're At" The U.S. Army Health Rick Appraisal Assessment; and U.S. Army Nutrition Objectives.

Sample: Health Risk Appraisal Assessment

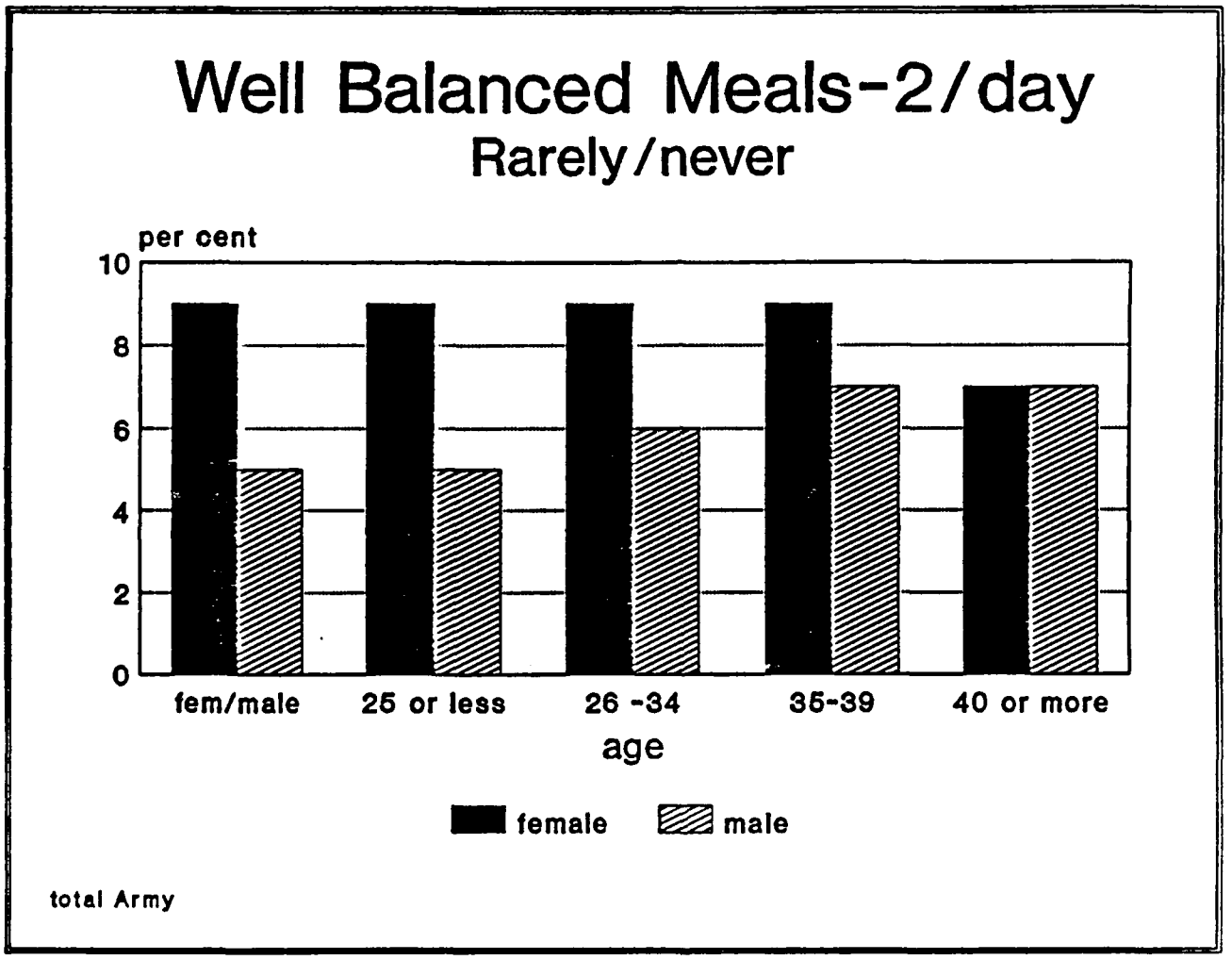
LTC J. Turcotte



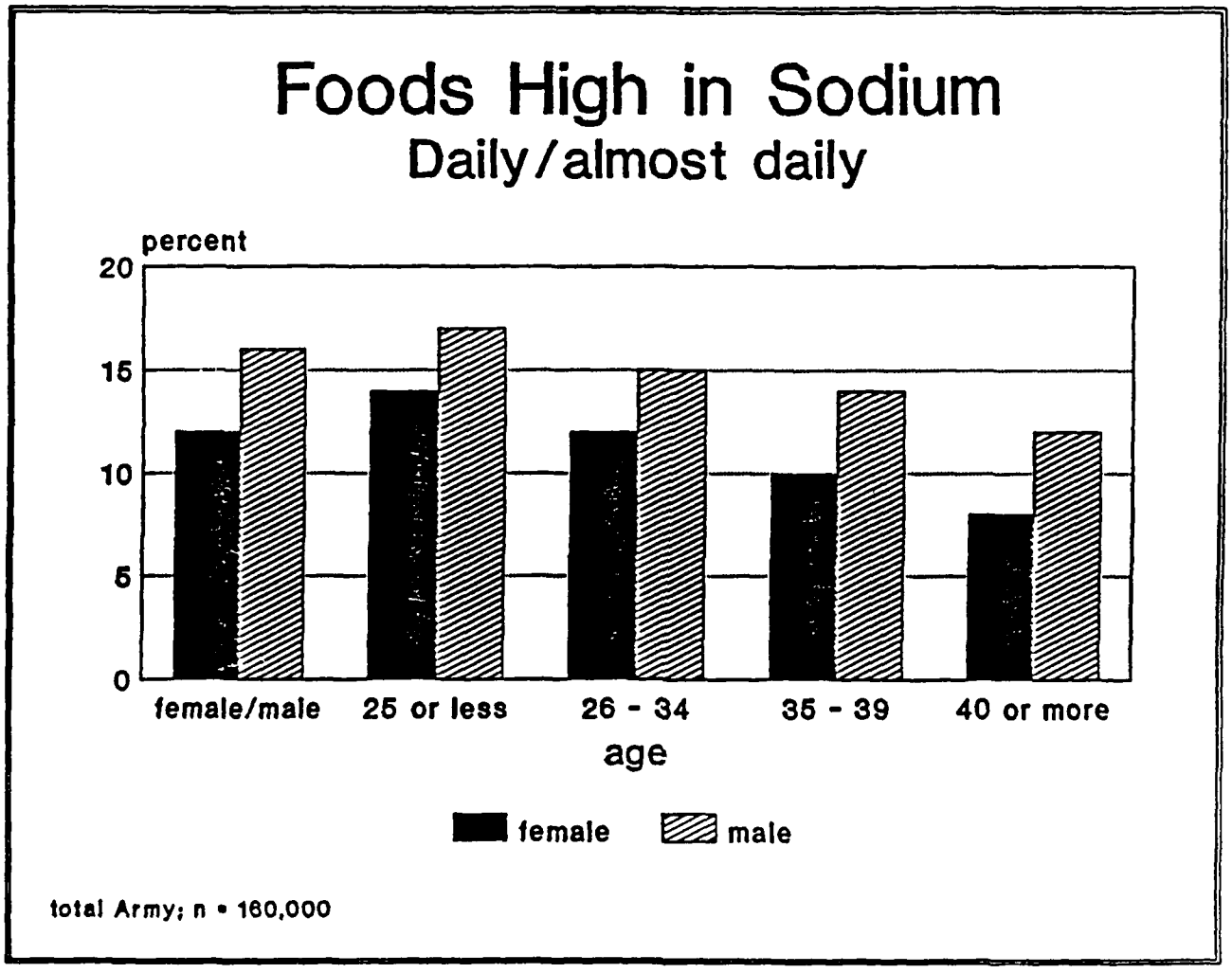
"Where We're At": Figure 1



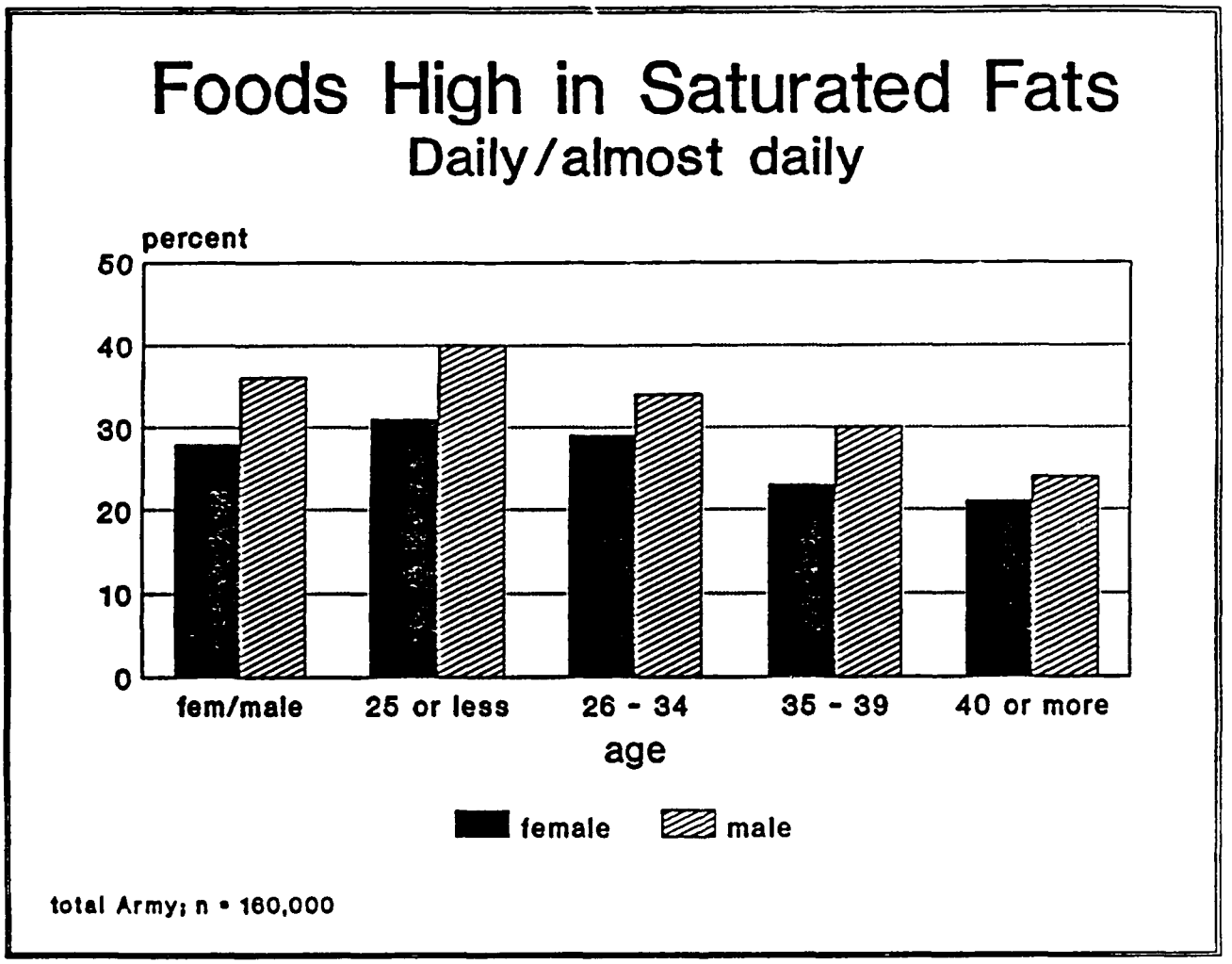
"Where We're At": Figure 2



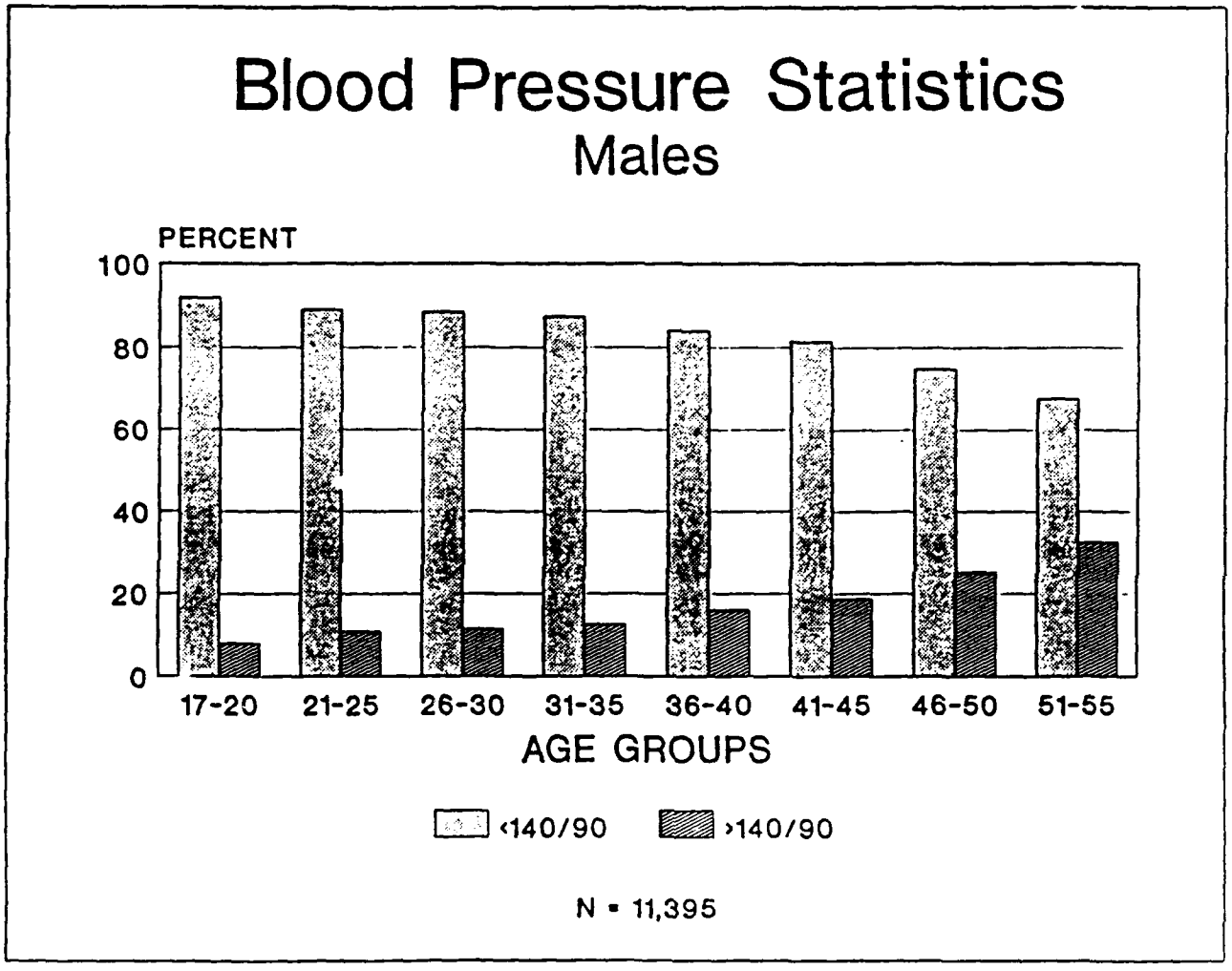
"Where We're At": Figure 3



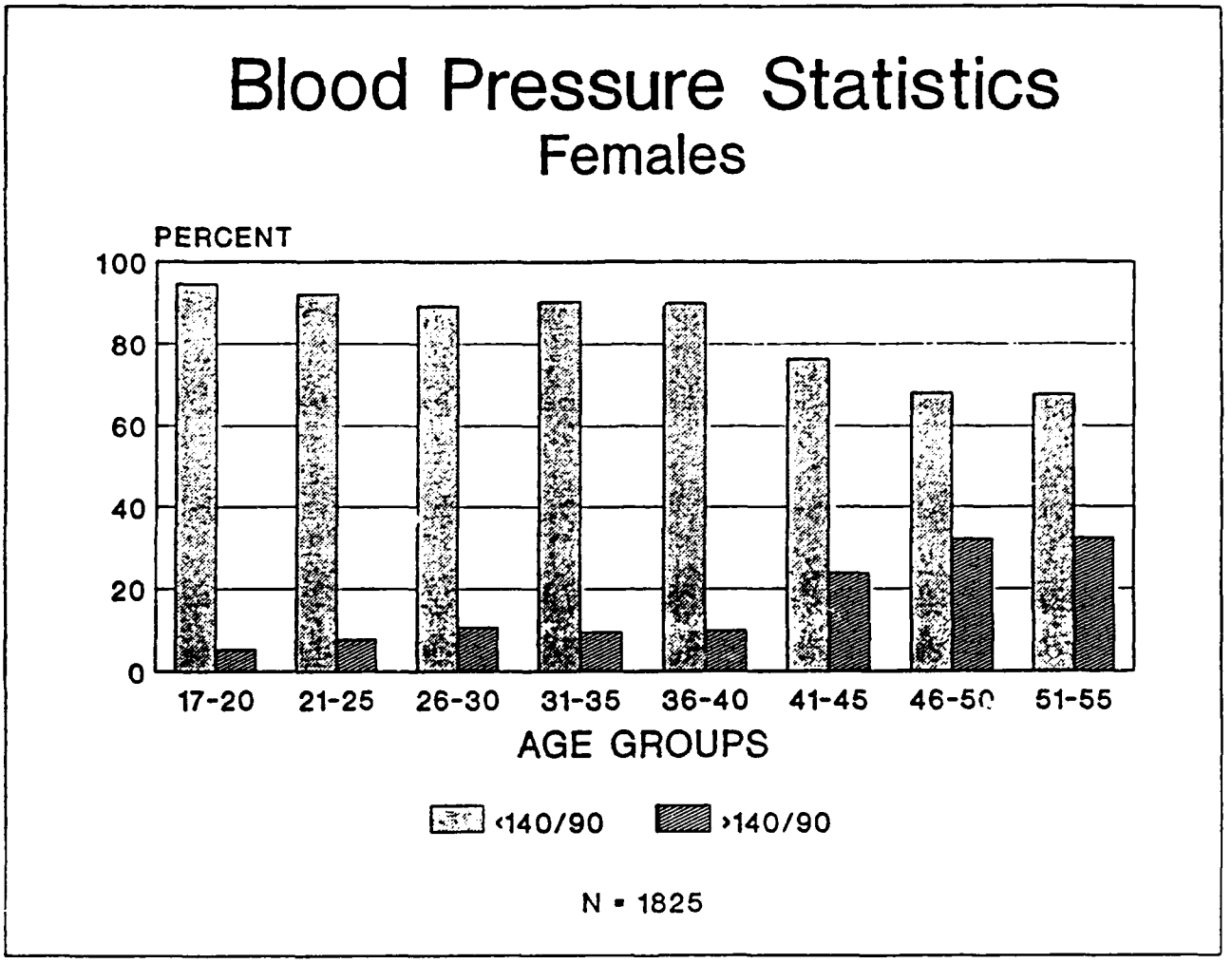
"Where We're At": Figure 4



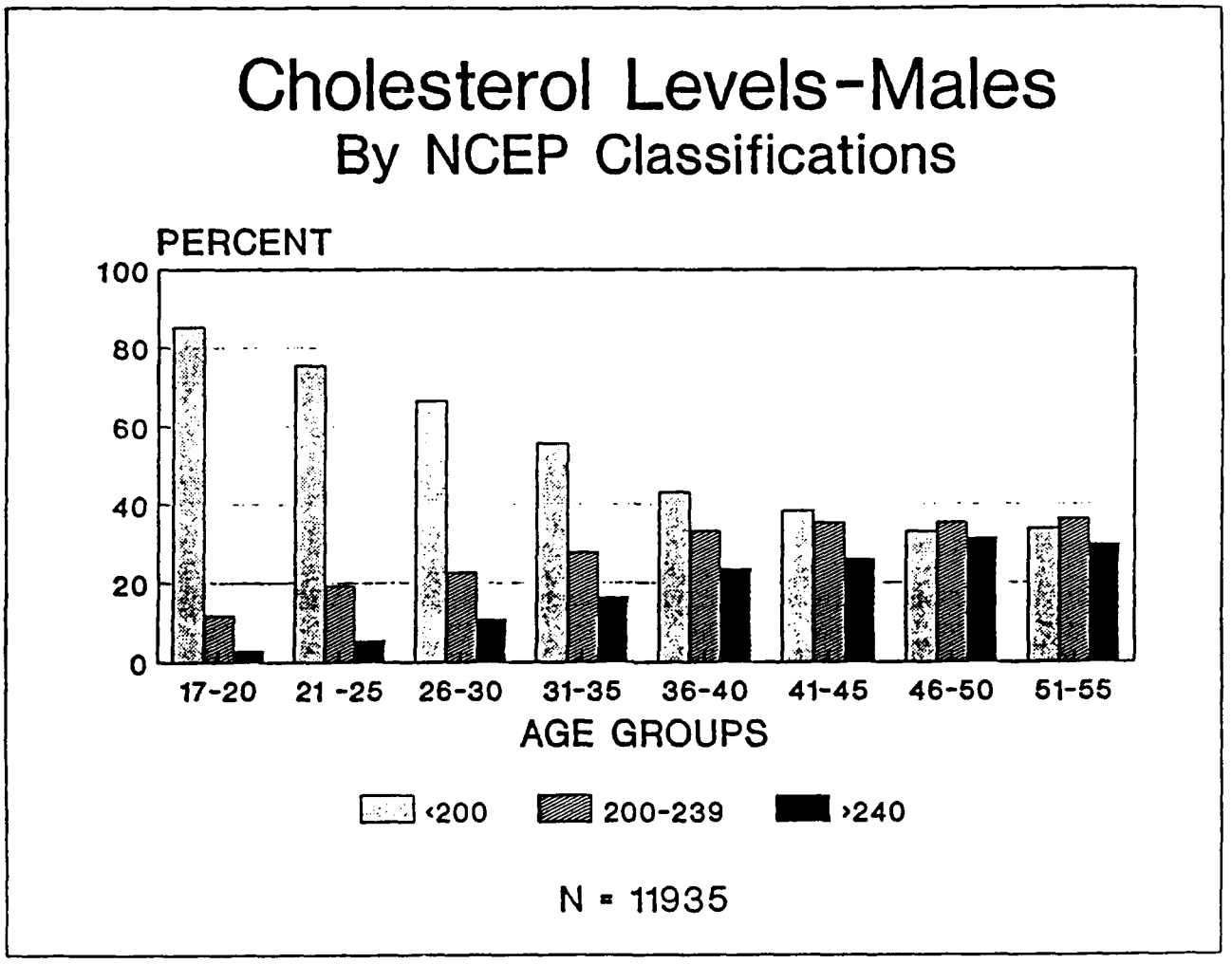
"Where We're At": Figure 5



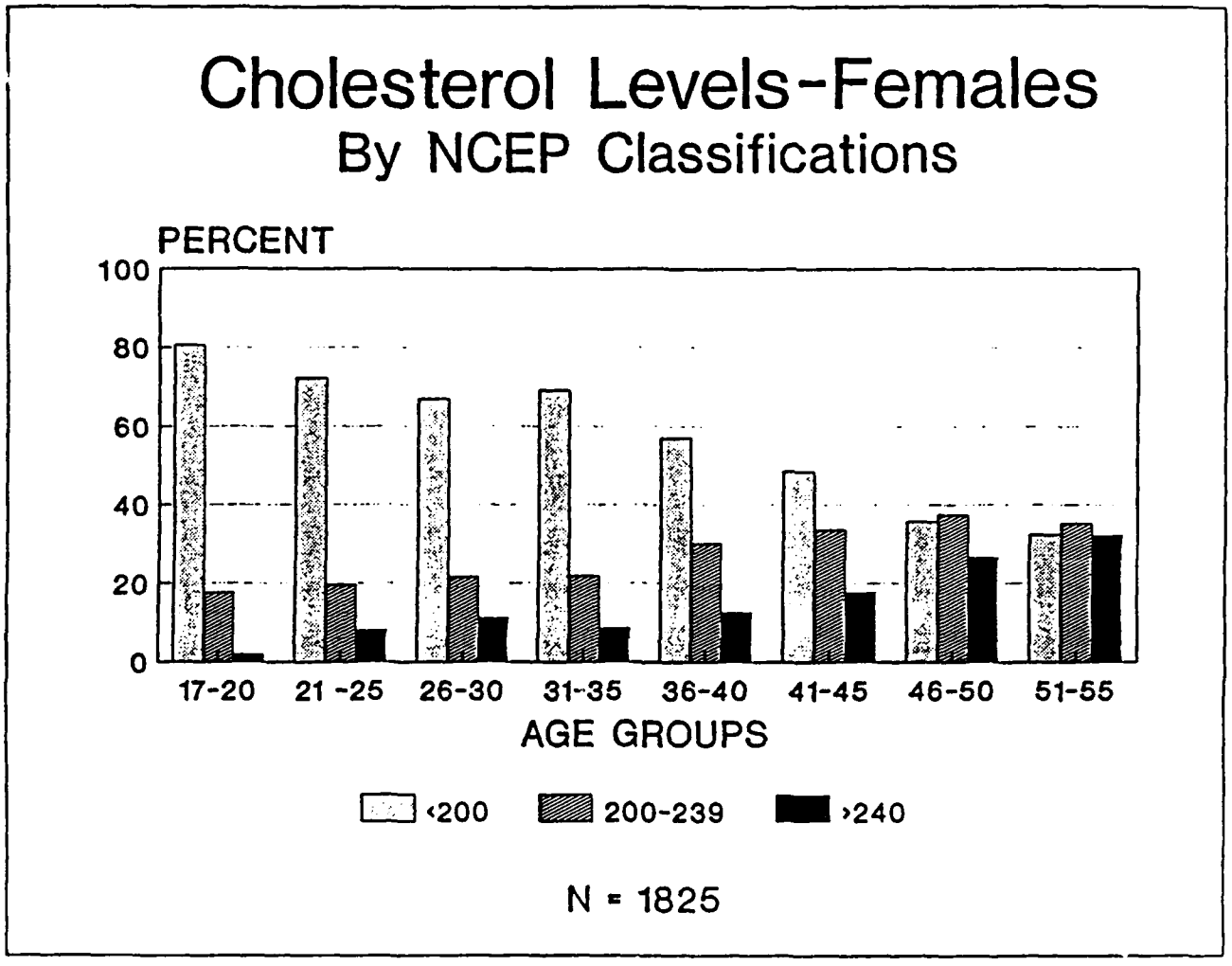
"Where We're At": Figure 6



"Where We're At": Figure 7



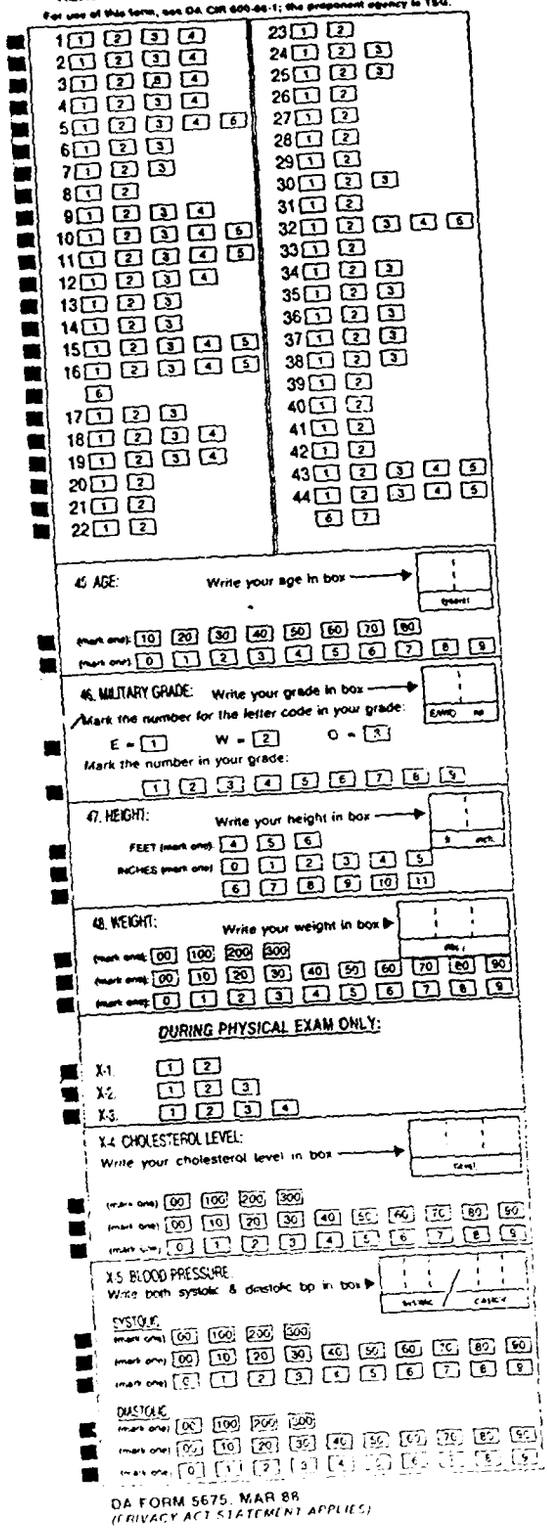
"Where We're At": Figure 8



"Where We're At": Figure 9

HEALTH RISK APPRAISAL ASSESSMENT (HRAA)

For use of this form, see DA CIR 600-85-1; the proponent agency is TSG.



DA FORM 5675, MAR 88
(PRIVACY ACT STATEMENT APPLIES)

HEALTH RISK APPRAISAL ASSESSMENT (HRAA)

For use of this form, see DA CIR 600-86-1; the proponent agency is TSG.

Directions: Please mark ALL your answers on the ANSWER CARD provided. Use a No. 2 pencil only, mark in the square completely, and erase any stray markings. Please answer EVERY question, but give only ONE answer per question.

1. How often do you eat two well-balanced meals per day?
   (1) daily or almost daily
   (2) 3 to 5 days a week
   (3) less than 3 days a week
   (4) rarely or never

2. How often do you eat foods high in saturated fats such as beef, hamburger, pork, sausage, butter, whole milk, cheese, etc..?
   (1) daily or almost daily
   (2) 3 to 5 days a week
   (3) less than 3 days a week
   (4) rarely or never

3. How often do you eat foods high in salt or sodium such as cold cuts, bacon, canned soups, potato chips, etc..?
   (1) daily or almost daily
   (2) 3 to 5 days a week
   (3) less than 3 days a week
   (4) rarely or never

4. How often do you eat high fiber foods such as whole grain breads, cereals, bran, raw fruit, or raw vegetables?
   (1) daily or almost daily
   (2) 3 to 5 days a week
   (3) less than 3 days a week
   (4) rarely or never

5. On the average, how many hours of sleep do you get each night?
   (1) less than 5 hours
   (2) 5 or 6 hours
   (3) 7 or 8 hours
   (4) 9 hours
   (5) more than 9 hours

6. How often do you do at least 20 minutes of non-stop aerobic activity (vigorous exercise that greatly increases your breathing and heart rate such as running, fast walking, biking, swimming, rowing, etc...)?
   (1) 3 or more times a week
   (2) 1 or 2 times a week
   (3) rarely or never

7. How often do you do exercises that improve muscle strength, such as pushups, situps, weight lifting, a Nautilus/Universal workout, resistance training, etc..?
   (1) 3 or more times a week
   (2) 1 or 2 times a week
   (3) rarely or never

8. Do you have a physical condition that limits or prevents you from exercising?
   (1) yes
   (2) no

9. Do you smoke cigarettes now?
   (1) yes
   (2) no, "I quit in the last 6 months"
   (3) no, "I quit over 6 months ago"
   (4) no, "I never smoked"

10. How much do you smoke now?
   (1) "I don't smoke"
   (2) less than a half-pack a day
   (3) one-half to one pack a day
   (4) one to two packs a day
   (5) two or more packs a day

11. How long have you smoked?
   (1) "I don't smoke"
   (2) less than 1 year
   (3) 2 to 4 years
   (4) 5 to 10 years
   (5) more than 10 years

12. Do you want to stop smoking?
   (1) "I don't smoke"
   (2) "I would like to quit now"
   (3) "I would like to quit someday"
   (4) "I don't want to stop smoking"

13. How often do you smoke a pipe or cigar?
   (1) never
   (2) less than daily
   (3) daily

14. How often do you use smokeless tobacco such as chewing tobacco or snuff?
   (1) never
   (2) less than daily
   (3) daily

15. In a typical week, how many days do you have at least one drink of alcohol (beer, wine, or liquor)?
   (1) "I don't drink"
   (2) 6 or 7 days per week
   (3) 3 to 5 days per week
   (4) 1 or 2 days per week
   (5) not even 1 day every week

16. In a typical week, how many drinks do you usually drink?
   (1) "I don't drink"
   (2) 4 or less
   (3) 5 to 12 drinks a week
   (4) 13 to 20 drinks a week
   (5) 21 to 30 drinks a week
   (6) more than 30 drinks a week

17. When driving or riding in a personal vehicle, how often do you wear seatbelts?
   (1) always/nearly always
   (2) sometimes
   (3) rarely or never

18. Do you ever drive after you've been drinking?
   (1) no, never
   (2) yes, but only rarely
   (3) yes, but not every time I go drinking
   (4) yes, almost every time I go drinking

19. Do you ever ride with a driver who has been drinking?
   (1) no, never
   (2) yes, but only rarely
   (3) yes, but not every time we go drinking
   (4) yes, almost every time we go drinking

20. In the past two years have you been ticketed for speeding or any other moving violation?
   (1) yes
   (2) no

21. In the last year, have you had a serious personal loss or misfortune (for example, promotion passover, divorce/separation, legal action, disciplinary action, bankruptcy, death of someone close, serious illness/injury of a loved one, etc..)?
   (1) yes
   (2) no

22. Have you experienced a major pleasant change in the past year (for example, promotion, marriage, birth, award, etc..)?
   (1) yes
   (2) no

23. Do you have trouble going to sleep and do not rest well?
   (1) yes
   (2) no

24. In the past year, have you experienced repeated or long periods of depression?
   (1) no
   (2) yes, sometimes
   (3) yes, often

25. In the past year, have your worries interfered with your daily life?
   (1) yes, sometimes
   (2) yes, often
   (3) no

26. Are there people you can turn to for support in bad moments or illness?
   (1) yes
   (2) no

27. Have you seriously considered suicide at least once in the last two years.
   (1) yes
   (2) no

CONTINUED ON THE OTHER SIDE

28. Have you or your family experienced a move or permanent change of station (PCS) in the past year?
(1) yes (2) no

29. In the last year, have you (or your family member) been separated from your home base for more than three weeks at a time?
(1) yes (2) no

30. Have you been informed in the last 5 years that either your blood pressure was high or borderline high?
(1) no (2) yes, high
(3) yes, borderline

31. Are you now being treated for high blood pressure?
(1) yes (2) no

32. What is your blood cholesterol level?
(1) under 200 mg%
(2) Between 200 and 250 mg%
(3) over 250 mg%
(4) "I don't remember"
(5) "I never had it measured"

33. Have you had discomfort above the waist (chest, shoulder, neck, jaw, arm pain, pressure, tightness) that starts from exertion but goes away with rest?
(1) yes (2) no

34. Do you do testicular self-exam (males) or breast self-exam (females)?
(1) no (2) yes, occasionally
(3) yes, at least monthly

35. Have any of your close blood relatives (parent, grandparent, brother, or sister) had a heart attack before age 60?
(1) no (2) yes (3) don't know

36. Have any of your close blood relatives (parent, grandparent, brother, or sister) had a stroke before age 60?
(1) no (2) yes (3) don't know

37. Have any of your close blood relatives (parent, grandparent, brother, or sister) had high blood pressure before age 60?
(1) no (2) yes (3) don't know

38. Have any of your close blood relatives (parent, grandparent, brother, or sister) had diabetes?
(1) no (2) yes (3) don't know

39. SEX: What is your sex?
(1) male (2) female

40. Females only: Have you had a Pap test in the last two years?
(1) yes (2) no

41. Females only: Have you had a breast examination in the past year?
(1) yes (2) no

42. Females only: Do you take birth control pills?
(1) yes (2) no

43. MARITAL STATUS: Are you currently...
(1) married or living as married
(2) separated & not living as married
(3) divorced & not living as married
(4) widowed & not living as married
(5) single, never married & not living as married

44. ELIGIBILITY STATUS: Are you...
(1) active duty military (but not in basic/advanced training)
(2) active duty military in basic or advanced training
(3) family member of active duty service member
(4) retired military
(5) family member of retiree
(6) civilian employee/federal employee
(7) other

45. AGE: Write your age in the box on the answer card, for example for twenty years of age write → 2 0 (years)

For the above example, here is a properly marked card:

■	(mark one):	10	●	30	40	50	60	70	80
■	(mark one):	●	1	2	3	4	5	6	7	8	9

Mark the first digit of your age.
Mark the second digit of your age.

46. MILITARY GRADE: Write your grade in the box on the answer card, for example for E3 write → E 3 (E/W/O no.)

Next, mark the code that refers to the letter (E/W/O) in your grade.
(1) E enlisted man/woman
(2) W warrant officer
(3) O officer

Mark the code that refers to the number in your grade (1-9).

47. HEIGHT: Write your height in the box on the answer card, for example for 6 feet and 0 inches, then write → 6 0 (ft. | inch.)

Mark the number that refers to the number of feet.
Mark the number that refers to the number of inches (0-11).

48. WEIGHT: Write your weight (without clothes) in the box on your answer card, for example if your weight is 170 lbs. then write → 1 7 0 (lbs.)

Mark the first digit of your weight.
Mark the second digit of your weight.
Mark the third digit of your weight.

FOR PERSONNEL DURING PHYSICAL EXAM ONLY:
(complete only with the guidance of health care personnel)

X-1. What was the result of your urine test?
(1) negative for sugar (2) positive for sugar

X-2. What was your blood sugar measurement?
(1) less than 120mg%
(2) greater than or equal to 120mg%
(3) did not have done

X-3. What was the result of your electrocardiograph (ECG)?
(1) LVH positive
(2) LVH negative
(3) other findings positive
(4) did not have done

X-4. BLOOD CHOLESTEROL: Write your blood cholesterol measurement in the box on your answer card, for example if your measurement was 190 then write → 1 9 0 (level)

Mark the first digit of your cholesterol level.
Mark the second digit of your cholesterol level.
Mark the third digit of your cholesterol level.

X-5. BLOOD PRESSURE: Write your blood pressure measurement (both systolic & diastolic) in the box on your answer card, for example if your measurement is 120/80 then write. → 1 2 0 (systolic) | 0 8 0 (diastolic)

Systolic:
Mark the first digit of your systolic blood pressure.
Mark the second digit of your systolic blood pressure.
Mark the third digit of your systolic blood pressure.

Diastolic:
Mark the first digit of your diastolic blood pressure.
Mark the second digit of your diastolic blood pressure.
Mark the third digit of your diastolic blood pressure.

APPENDIX IIi.

Information Paper: Nutrition Initiatives

INFORMATION PAPER

DASG-DBD
10 July 1989

SUBJECT: Nutrition Initiatives

1. Purpose. To present facts relative to nutrition initiatives which have been undertaken in active Army dining facilities.

2. Facts.

a. The Army Surgeon General serves as the DOD Executive Agent for Nutrition. The Chief, Dietitian Section assist the Surgeon General in the execution of his duties by establishing Nutrition policy for garrison and field feeding.

b. In response to a tasking by the Vice Chief of Staff of the Army in 1985, initiatives designed to heighten soldier's awareness of the importance of nutrition, to educate soldiers to make appropriate food choices, and to provide a variety of nutritious menu alternatives to soldiers were implemented in active Army dining facilities.

c. Nutrition initiatives undertaken in dining facilities are outlined in Appendix J of AR 30-1 (The Army Food Service Program). Food service supervisors, including those overseeing contract food services, are required to meet the standards of AR 30-1. Categories include menu, preparation and serving, training, and dining facility standards. Required standards include:

(Menu standards--the availability of:)

(1) Unsweetened, ready-to-eat, and whole grain cereals (for breakfast)

(2) Fresh or canned fruit or unsweetened juice at each meal

(3) Noncaloric beverages, and sugar substitutes

(4) Margarine available as a spread

(5) Whole grain breads and rolls at each meal

(6) Lowfat milk (2%) offered as the primary milk source in bulk milk dispensers at each meal, with skim offered as an alternative

(7) Herbal seasoning mixtures for table use

(8) Low calorie dressings

(9) Provision of low calorie menus for both the regular menu and short order line

(Preparation and Serving Standards)

(1) Adherence to standardized recipes contained in TM 10-412

(2) Meats are trimmed of excess fat, and reduced portion sizes of foods are available

(3) A nonfried entree is offered as an alternative when a fried entree is featured.

(4) Cooked vegetables are served without margarine, butter, sauces, or gravies.

(Training Standards):
(1) Diner education program exists, and includes information on the caloric value of each menu component, and the availability of nutrition education materials.
(2) Installation training programs are established to provide food service personnel assistance in the implementation of nutrition standards.

d. Breakfast bars were implemented in 1986, in an attempt to offer lower fat, cholesterol, and increased fiber choices over the traditional meal of eggs and breakfast meats. Potential choices include assorted whole grain cereals, muffins, assorted fruits, yogurt, and other items.

e. Armed Forces Recipe File, TM 10-412.
Over the past three years, the Armed Forces Recipe Service, chaired by the Navy, has worked to decrease sodium and fat in recipes and increase the number of available low calorie recipes.

f. Master Menu Revision.
The Army Master Menu has also been reduced in sodium and fat. Successful implementation of lowfat milk as the primary milk source has contributed to the reduced fat level of the menu.

g. Food consumption studies. Studies undertaken by the U.S. Army Research Institute of Environmental Medicine to evaluate the effectiveness of nutrition initiatives in altering soldier's eating habits revealed that positive gains have been achieved. Overall, the soldier's fat consumption studied at three garrison dining facilities (Ft. Riley, Devens, and Lewis) was at 37% of total calories, which was within reach of the 35% standard established by the Military Recommended Dietary Allowance (MRDA) contained in AR 40-25, Nutrition Allowances, Standards, and Education. Sodium intake was within the 1400-1700 milligrams (mg) per 1000 calories, but cholesterol intakes were well over the recommended amount set by various health organizations. No MRDA for cholesterol has been established. However, in a recent study of basic trainees conducted at Fort Jackson, SC, calories consumed from fat were at thirty four percent, and the cholesterol consumption of women surveyed was significantly lower than previous studies, due to decreased intake of eggs and fatty meats.

DASG-DBD
SUBJECT: Nutrition Initiatives

h. Nutrition education.

(1) Nutrition education remains the cornerstone of motivating people to adopt healthier eating habits. The medical treatment facility (MTF) dietitian, the division nutritionist, and other health care professionals have a major responsibility in communicating principles of sound nutrition to the total Army.

(2) Because of results of USARIEM studies, the recent report of the National Cholesterol Education Program, and the Surgeon General's Report on Nutrition and Health, the thrust of current nutrition education efforts are to encourage soldiers to reduce their consumption of fat, cholesterol, and sodium.

(3) Three newly adopted Army Nutrition Goals are to improve the health and readiness of the Army through nutrition by:

--reducing fat consumption to not more than 30% of total calories by 1998

--reducing cholesterol consumption to not more than 300 mg/day by 1993

--reducing sodium consumption to no more than 1400-1700 mg per 1000 calories consumed.

(4) Commissaries are actively involved in providing nutrition education for consumers. Produce and meat case signs display the nutrient data and nutrition education pamphlets are available on these items. A shelf labelling program for meats and dairy products is being planned for implementation in 1989.

(5) National Nutrition Month (NNM). Each March the Army joins in the national promotion of nutrition month. A resource packet with ideas for promoting NNM at each installation is compiled and sent to MTF dietitians, food advisors, public affairs officers, and Fit to Win Coordinators.

i. Army nutrition initiatives are consistent with national health objectives, and in some areas, exceed the national objectives. The current and future garrison ration will continue to support the nutritional needs of soldiers necessary to sustain an effective fighting force.

COL Cronin, OTSG, 756-0068

Nutrition and Readiness ... Inseparable

APPENDIX IIj.

Overview:
National Evaluation of Military Feeding Systems and Military Populations

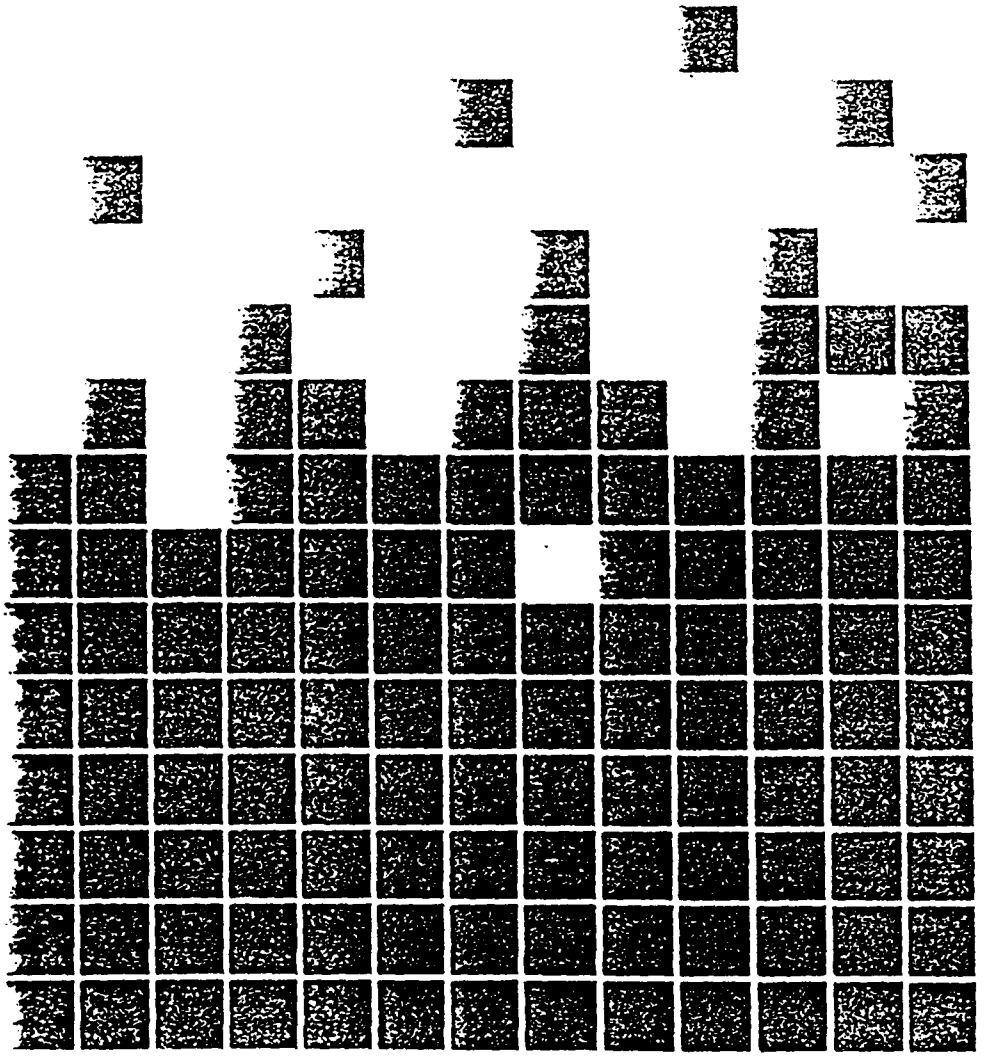
Presentation Graphics: Current U.S. Army Dietary Intakes of Fat, Cholesterol and Sodium.

LTC E. Wayne Askew

Nutrition Monitoring in the United States

The Directory of Federal Nutrition Monitoring Activities

Prepared by the Interagency Committee on Nutrition Monitoring



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service

U.S. DEPARTMENT OF AGRICULTURE
Food and Consumer Services

Hyattsville, Maryland
September 1989

DHHS Publication No. (PHS) 89-1255

Nutritional Evaluation of Military Feeding Systems and Military Populations

Sponsoring Agency: U.S. Army Research Institute of Environmental Medicine (USARIEM), Department of Defense

Conducted: Ongoing since 1985

Purpose: The results of these studies are used to determine the nutritional adequacy of the diet consumed by male and female military personnel in both a peacetime garrison situation and during sustained physically demanding military training exercises at all climatic extremes. Based on the results, standardized recipes and menus, the cook training program, and specifications for food items and combat rations purchased by the DOD are modified to improve nutritional health and maintain optimal physical and mental performance of military personnel.

Target Population: Primarily male and female enlisted personnel of the Army, Navy, Marine Corps, and Air Force assigned to military installations in the continental United States, Alaska, Hawaii, and potentially overseas. Populations studied to date have included Army basic trainees at Fort Jackson, South Carolina; Non-Commissioned Officer Academy trainees at Fort Riley, Kansas; enlisted personnel assigned to Fort Lewis, Washington, and Fort Devens, Massachusetts; Army units training at Pohakuloa Training Area, Hawaii, Fort Wainwright and Fort Greely, Alaska; Special Forces units training in the White Mountains of Vermont; and Marine units training at the Mountain Warfare Training Area, Pickle Meadows, California. Future studies planned include a multiyear evaluation of a prototype nutritional health and fitness program at Fort Polk, Louisiana, including monitoring changes in nutrient intakes and nutritional status of military personnel and their spouses and dependents. A comprehensive nutritional assessment is also planned for cadets and their dining facility at the U.S. Army Military Academy at West Point, New York.

Design: Varies with objectives of each specific study.

Sample Size and Response Rate: The sample size has varied between 20 and 240 personnel depending on objectives of each specific study. Usually 90–99 percent of all subjects who voluntarily participate complete all aspects of data collection.

Measures: Total daily food and fluid intakes usually for periods of 7–14 days (sometimes 4–6 weeks). Food intakes are collected by visual observation or dietary record-interview technique. Other measures usually included are body weight and body composition changes, hydration status, blood lipid profile, and food acceptability (hedonic rating) data. Frequently, muscle strength and aerobic endurance, cognitive function, energy expenditure (doubly labeled water method), physical activity patterns (wrist accelerometer), biochemical assessment of vitamin status, and nutritional knowledge and attitude data are also measured. Nutrient intakes are derived using food intake and from chemical analyses of food items and rations, monitoring recipes as prepared by cooks in dining facilities, and USDA derived foods composition data files. Military Recommended Dietary Allowances (based upon RDA's) are used as reference to assess nutritional adequacy of diets consumed.

Control Variables:

Feeding system—Garrison dining facility, field feeding system, and type of combat ration or supplement.

Training environment—Hot-dry, hot-humid, cold and temperate climates, mountain terrain.

Individuals—Gender, race, physical activity level, age; active, reserve, trainees, and special operations personnel.

Accessibility and Availability: Results are published as either USARIEM Technical Reports or are submitted to scientific journals. Raw or summarized data tapes are not available. A list of publications and technical reports is available from the contact person.

Contact Person: LTC E. Wayne Askew, Ph.D.
Director, Military Nutrition Division
U.S. Army Research Institute of Environmental Medicine
Natick, Massachusetts 01760-5007
(508) 651-4874

Selected Key Publications:

Askew EW, Munro I, Sharp MA, et al. *Nutritional Status and Physical and Mental Performance of Special Operations Soldiers Consuming the Ration, Lightweight or the Meal, Ready-to-Eat Military Field Ration During a 30-Day Field Training Exercise.* USARIEM Technical Report No. T7-87, Mar. 1987.

Rose RW, Baker CJ, Wisnaskas W, et al. *Dietary Assessment of the U.S. Army Basic Trainees at Ft. Jackson, SC.* USARIEM Technical Report T6-87, Jan. 1989.

Schnakenberg DD, Carlson DE, Sawyers M, et al. Nutritional Evaluation of a New Combat Field Feeding System for the Army. *Army Science Conference Proceedings* 4:69–80, June 17–19, 1986.

Primary Focus of Evaluations

- **Measure fat, sodium, cholesterol intakes from meals served in a sample of Army dining facilities**
- **Evaluate progress towards achieving recommendations**

Current U.S. Army Dietary Intakes of Fat, Cholesterol and Sodium: Figure 1

Nutrition Initiatives Evaluations*

Aug 86 - Ft Riley, KS	NCO Academy Dining Facility
Nov 86 - Ft Lewis, WA	80th Ordnance Bn Dining Facility
Aug 87 - Ft Devens, MA	Consolidated Dining Facility
Jan 88 - Ft Devens, MA	Evaluate Cholesterol Lowering Initiative
Aug 88 - Ft Jackson, SC	Male and Female Basic Trainees

* Conducted by military nutrition division, US Army Research institute of Environmental Medicine, Natick, MA

Current U.S. Army Dietary Intakes of Fat, Cholesterol and Sodium: Figure 2

Ft Jackson Study

Population Sampled 1st - 3rd Week of Basic Training

	Males	Females
n	41	40
Age	19	20
Height (in)	69	64
Weight (lbs)	155	130
White (%)	56	63
Black (%)	32	18
Hispanic (%)	12	18

Ft Jackson Study

Parameters Measured

- 7 days dietary intakes (visual estimation technique)
- Monitored food preparation
- Surveyed nutrition knowledge, attitudes, awareness, food habits
- Blood lipids on 128 males and 130 females including dietary subjects

Blood Lipids and Fat Intakes Of Basic Trainees at Ft Jackson

	MALES (n = 40)	FEMALES (N=39)
AGE (YRS)	19	20
TOTAL CHOLESTEROL (MG/DL)	149±29	165±26
LDL (MG/DL)	92±27	98±25
HDL (MG/DL)	51±12	59±14
TRIGLYCERIDES (MG/DL)	56±16	63±21
FAT INTAKES (%KCAL)	34±10	34±10
Comparison to USA Civilian Population		
1976-80 NHANES II, 20-24 yrs Total cholesterol (mg/dl)	180	184

Current U.S. Army Dietary Intakes of Fat, Cholesterol and Sodium: Figure 5

Trends in Total Fat Intakes in Military Dining Facilities

PRE-INITIATIVES		% Fat Cals
1952	FT SHERIDAN	46.0
1953	FT RILEY	48.6
1966	FT HUACHUCA	45.5
1971	LOWRY AFB	42.5
1976	US ARMY MIL ACAD	41.8
1977	USS SARATOGA	42.1

POST-INITIATIVES		% Fat Cals
1986	FT RILEY	37.6
1986	FT LEWIS	38.4
1987	FT DEVENS	38.2
1988	FT JACKSON	
	Males	34
	Females	34

Comparison to USA Civilian Population

1977-78 USDA NFCS		
	Males 20-29 yrs	41
	Females 20-29 yrs	40
1976-80 NHANES II		
	Males 20-29 yrs	36
	Females 20-29 yrs	36

1985-86 USDA CFS II		
	Males 20-29 yrs	36
	Females 20-29 yrs	36

Current U.S. Army Dietary Intakes of Fat, Cholesterol and Sodium: Figure 6

Trends in Cholesterol Intakes in Military Dining Facilities

Pre-Initiatives	mg/1000 Kcal	Post-Initiatives	mg/1000 Kcal
1977 USS Saratoga	271	1986 Ft Riley	244
1978 USS Saratoga	258	1986 Ft Lewis	236
1976 US Army Mil Acad		1987 Ft Devens	227
Males	182	1988 Ft Devens	215
Females	211	1988 Ft Jackson	
		Males	225
		Females	170

Comparison to USA Civilian Population

1976-80 NHANES II		1985-86 USDA CSFII	
Males 20-29 yrs	156	Males 20-29 yrs	166
Females 20-29 yrs	161	Females 20-29 yrs	121

Current U.S. Army Dietary Intakes of Fat, Cholesterol and Sodium: Figure 7

Trends in Sodium Intakes in Military Dining Facilities

Pre-Initiatives		mg/1000 Kcal	Post-Initiatives *		mg/1000 Kcal
1971	Lowry AFB	1562	1986	Ft Riley	1796
1972	Ft Myer	1316	1986	Ft Lewis	1532
1975	NAS/Alameda	1351	1987	Ft Devens	1764
1976	US Army Mil Acad	1150	1988	Ft Devens	1709
			1988	Ft Jackson	
				Males	1856
				Females	1819

*** Includes added table salt (Avg 4-10% of total)**

Comparison to USA Civilian Population

1976-80 NHANES II		1985-86 USDA CSFII	
Males 20-29 yrs	1351	Males 20-29 yrs	1433
Females 20-29 yrs	1435	Females 20-29 yrs	1549

Current U.S. Army Dietary Intakes of Fat, Cholesterol and Sodium: Figure 8

Trends in Dietary Recommendations

	FAT	CHOLESTEROL	SODIUM
RDA (1980)	--	--	1100-3300 mg/day*
MRDA (1985)	<35%	--	1400-1700 mg/1000 Kcal
Diet & Health (1989)	<30%	<300 mg/day	<2400 mg/day
RDA (1989)	<36% desirable	--	500 mg/day**
DoD Current Intakes	34-38%	170-240 mg/1000 Kcal	1500-1850mg/ 1000 Kcal
MRDA (Revised)	?	?	?

* Safe and adequate

** Safe minimum requirement

Current U.S. Army Dietary Intakes of Fat, Cholesterol and Sodium: Figure 9

CONTENTS OF APPENDIX III

Committee on Military Nutrition Research
Meeting June 28-29, 1990

IIIa - Agenda and List of Committee Participants

IIIb - Information Paper: Dietary Assessment Surveys to Evaluate the Effectiveness of the Nutrition Initiatives including charts illustrating project results

APPENDIX IIIa.

Agenda and List of Committee Participants

FINAL AGENDA

COMMITTEE ON MILITARY NUTRITION RESEARCH
U.S. ARMY RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE
NATICK, MASSACHUSETTS

JUNE 28 - 29, 1990

Thursday, June 28:	**Food Engineering Directorate Conference Room - Building E-100**
8:00 AM	Meet in hotel lobby for transportation to USARIEM
8:30 - 8:45	Welcome to USARIEM - Col. Joseph Denniston, Commander
8:45 - 9:00	Chairman's remarks, review of status of committee work and plan for the meeting - Robert O. Nesheim, Ph.D.
9:00 - 9:45	Physiological Considerations for Design of Survival Rations and an Historical Perspective - R. E. Johnson, M.D., D.D. Phil.
9:45 - 11:00	New Generation Survival Ration - Presentations by staff of the Food Engineering Directorate, NRDEC and discussion
11:00 - 12:00	Long Life Ration Packet (LRPII) - Presentations by staff of the Food Engineering Directorate, NRDEC and discussion
12:00 - 1:00	Luncheon: Committee will have opportunity to sample the rations
1:00 - 2:30	Alaska Cold Weather Comparison of MRE VIII + Supplemental Packet versus the Ration, Cold Weather - Lt.Col. John Edwards, Ph.D., Military Nutrition Division, USARIEM
2:30 - 2:45	Reconstituted Milk Processing Enhancements - Andre Senecal, Food Engineering Directorate, NRDEC
2:45 - 3:15	Army Nutrition Initiatives: Follow-up Discussion
3:15 - 4:00	Discussion of Plans to Review and Revise the MRDA's (AR 40-25, Nutritional Standards and Allowances) - Background information presentation - Lt.Col. Eldon W. Askew, Ph.D , Director, Division of Military Nutrition, USARIEM
4:00 - 4:30	Optional Informal Tour of Research Facilities
6:30	Pick-up at hotel for dinner
7:00	No host Dinner at Finnerty's, Wayland, Massachusetts
Friday, June 29:	**Executive Session of the Committee**

COMMITTEE ON MILITARY NUTRITION RESEARCH
Conference June 28-29, 1990
Committee Participants

Robert O. Nesheim, Ph.D.
(Chairman)
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Advanced Healthcare, Inc.
Monterey, CA

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VA Medical Center
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Professor of Nutrition Biochemistry
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Joel Grinker, Ph.D.
Program and Human Nutrition
School of Public Health
University of Michigan

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Un. of Vermont, Coll. of Medicine

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Natick, MA

Not able to attend:

John Kinsella, Ph.D.
Dept of Food Science
Cornell University

Richard Jansen, Ph.D.
Professor and Head, Dept of
Food Science and Human Nutrition
Colorado State University

APPENDIX IIIb.

Information Paper: Dietary Assessment Surveys to Evaluate the Effectiveness of the Nutrition Initiatives

INFORMATION PAPER

SGRD-UE-NR
12 January 1990

SUBJECT: Dietary assessment surveys to evaluate the effectiveness of the nutrition initiatives

1. ISSUE. Nutrition initiatives designed to heighten soldier awareness of the importance of nutrition, to educate soldiers to make appropriate food choices, and to provide a variety of nutritious menu alternatives in military dining facilities were implemented in 1985 in response to a tasking by the Vice Chief of Staff of the Army. It was determined that dietary surveys were needed to determine if the initiatives were effective in promoting a healthy diet, and what problems still remained.

2. FACTS.

- USARIEM conducted dietary surveys at 5 active Army installations to determine if the initiatives were effective (encl 1).

- The surveys indicated that dietary fat comprised about 37% of total calories at 3 installations surveyed in 1986 and 1987, but had reached the goal of 35% by the last survey in 1988 (encl 2).

- The surveys identified that the most effective ways to reduce fat in the diet were to use low fat milk and to reduce the availability of high fat items that are generally standard fare ir dining facilities, especially in short order lines.

- The surveys indicate that most dietary cholesterol is from eggs eaten at the breakfast meal, and that meaningful reductions in cholesterol intake must begin at this meal.

- Survey data indicates that over 95% of the sodium eaten is contained in food and not added at the table. Thus, any attempt to reduce sodium intakes must concentrate on reducing menu sodium contents.

- The survey findings were major factors considered in the defining the core areas of the current Army nutrition education efforts aimed at reducing fat consumption to not more than 30% of total calories by 1998, reducing cholesterol consumption to less than 300 mg by 1993, and reducing sodium consumption to 1400-1700 mg per 1000 calories consumed.

Approved by: COL Denniston

Action Officer: LTC Askew/AV 256-4874

2 Encls

DASG-DBD/DALO-TST
17 January 1990

INFORMATION PAPER

SUBJECT: Army Nutrition Initiatives

1. Purpose. To provide the Vice Chief of Staff, Army with information on the status of Army nutrition initiatives to reduce total fat and cholesterol intakes.

2. Facts.

a. The Army Surgeon General is the DoD Executive Agent for nutrition. AR 40-25, Nutrition Allowances, Standards and Education, is a joint service regulation which provides the Military Recommended Dietary Allowances for soldier intake of calories and other nutrients; sets nutrient standards for operational rations; and provides guidance on nutrition education to promote healthful eating habits for the military population. A Military Nutrition Committee of the prestigious National Academy of Sciences Food and Nutrition Board is currently assisting the Surgeon General in reviewing the current scientific database and revising AR 40-25.

b. The latest (1985) version of AR 40-25 recommends that total fat intakes should not exceed 35 percent of calories in garrison and establishes a target of 1400-1700 milligrams of sodium per 1000 calories. No specific cholesterol recommendations are provided other than advising military personnel and their dependents to reduce saturated fat and cholesterol intakes.

c. In response to a 1985 tasking by the Vice Chief of Staff, Army, many initiatives have been implemented to heighten soldier's awareness of the importance of nutrition; to educate soldiers and families to make appropriate food choices; to provide a variety of nutritious menu alternatives in dining facilities; and to reduce the level of sodium and total fat in recipes and menus.

d. The Army Master Menu has been reduced in fat and sodium The level of fat has been reduced from 40 percent of calories in the 1984 menu to 35 percent of calories in the 1989 menu. The successful implementation of lowfat milk as the primary milk source has contributed to maintaining this lower fat level and is well accepted by the troops. Although the 35 percent of calories from fat achieves the Surgeon General's standard, the menu is not mandatory at installation level and soldier's actual intake of total fat may be higher.

e. The Armed Forces Recipe File has also undergone major changes over the past three years to reduce sodium and fat in recipes. Margarine, rather than butter, is identified as the fat component in recipes and as the preferred table spread. The work

of the Armed Forces Recipe Committee, chaired by the Navy, is now complete for revision of all applicable recipes to reduce fat and sodium.

f. Breakfast bars were implemented in 1986 in an attempt to offer lower fat, cholesterol and increased fiber choices over the traditional meal of eggs and breakfast meats. The breakfast bar offers such choices as whole grain cereals, muffins, fruits and yogurt. Our new theme, "Breakfast is the Time of Day to Practice Good Nutrition", is a direct result of our recognized need to emphasize the importance of eating breakfast.

g. AR 30-1, The Army Food Service Program, outlines nutrition standards which dining facilities must follow in menu preparation and service, training of personnel and implementing diner education.

h. At the request of the ODCSLOG, The U.S. Army Reseaarch Institute of Environmental Medicine has undertaken studies to evaluate the effectiveness of dining facility nutrition initiatives in altering soldier's eating habits. Their results (Table 1) from four garrison dining facilities found the Army's nutrition intiatives are effectively lowering fat intakes. Sodium intakes are only slightly above recommendations. However, cholesterol intakes were well over the recommended amount (300 milligrams/day) set by various health organizations such as the American Heart Association and the Department of Health and Human Services National Cholesterol Education Program. USARIEM plans to re-evaluate nutrient intakes at the U.S. Military Academy in April 1990.

i. Two recently adopted Army nutrition goals to improve the health and readiness of the Army include:

(1) educating soldiers to reduce cholesterol consumption to not more than 300 milligrams/day by 1993

(2) reducting fat consumption to not more than 30 percent of total calories by 1998.

j. The nutrition standards for the fat and sodium contant of operational rations are higher than for garrison rations. However, Table 2 illustrates, fat and cholesterol content of the MRE and T Ration are at or below the levels in garrison rations The actual fat, cholesterol and sodium intakes recorded by USARIEM from soldiers fed various combinations of A, B, T, and MRE rations during field exercises at Pohakuloa Training Area, Hawaiii are provided at Table 3. USARIEM is conducting further ration trials with the 6th Infantry Division in February 1990 and in July 1990 during "Fuertes Caminos 90" at Potos, Bolivia (elevation 13,500 feet).

k. Army nutrition initiatives are consistent with national health objectives, and in some areas, exceed the national objectives. The military environment offers a unique opportunity to conduct longitudinal nutrition studies. Current and future rations support and will sustain the nutritional needs of a training and fighting force. Nutrition education remains the cornerstone in motivating soldiers and families to adopt healthier eating habits.

Colonel Cronin, R.D., DASG-DBD/756-0066
Mrs. Adolphi, R.D., DALO-TST/48068

TABLE 1

FAT, CHOLESTEROL AND SODIUM INTAKES FROM GARRISON RATIONS

	FAT (% of calories)	CHOLESTEROL (mg/day)	SODIUM (mg/1000 kcal)
PRE-NUTRITION INITIATIVES			
1953 Ft Riley	**48**	**N/A**	**N/A**
1979 USMA			
Male Cadets	42	599	N/A
Female Cadets	42	403	N/A
POST-NUTRITION INITIATIVES			
1986 Ft Riley (1)	**38**	**761**	**1796**
1986 Ft Lewis(2)	**37**	**748**	**1532**
1987 Ft Devens (3)	**38**	**677**	**1764**
1988 Ft Jackson (4)			
Male Trainees	**34**	**703**	**1856**
Female Trainees	**34**	**418**	**1819**
RECOMMENDED (AR 40-25)	**35**	**N/A**	**1400-1700**

(1) Carlson, D. et al. Nutritional Assessment of the Ft Riley Non-Commissioned Officer Academy Dining Facility. USARIEM Tech Report No. T14-87, 1987.

(2) Szeto, E. et al. A Comparison of Nutrient Intakes between a Ft Riley Contractor-Operated and a Ft Lewis Military-Operated Garrison Dining Facility. USARIEM Tech Report No T2-88, 1987.

(3) Szeto, E. et al. Assessment of Habitual Diners Nutrient Intakes in a Military-Operated Garrison Dining Facility. Ft Devens I. USARIEM Tech Report T3-89, 1988.

(4) Rose, R.W. et al. Dietary Assessment of U.S. Army Basic Trainees at Ft Jackson. USARIEM Tech Report T6-89, 1989.

TABLE 2

SELECTED NUTRIENT CONTENT
OF OPERATIONAL RATIONS
(PER MEAL)

	Standard*	A Ration#	T Ration	MRE VIII
Energy (Kilocalories)	1200	1149**	1430**	1306
Protein (Gm)	33	41	59	49
Carbohydrate (Gm)	147	149	191	161
Fat (Gm)	53 (max)	43	47	52
(% of calories)	40 (max)	34	30	36
Cholesterol(mg)	No MRDA	not analyzed	196	119
Sodium (mg)	1667-2333	1691	2468	1813

*From AR 40-25, nutritional standards for operational rations; each meal should provide 1/3 of daily nutrient requirements

** Total calorie intake will vary depending on foods selected by the soldier

Analysis of A Ration menu from SB 10-163, 14-Day U.S. Army Reserve Component and Field Training Menu

TABLE 3

FAT, CHOLESTEROL AND SODIUM INTAKES FROM OPERATIONAL RATIONS

	FAT (% of calories)	CHOLESTEROL (mg/day)	SODIUM (mg/1000 kcal)
1985 CFFS-FDTE (1)			
2T/1MRE	31	294	1757
1T/2MRE	34	170	1848
2A/1MRE	42	770	1805
2B/1MRE	35	N/A	1812
1986 IMPROVED MRE TEST (2)			
3 MRE IV	42	est. <300	1980
3 MRE VIII	33	est. <300	1762

(1) Combat Field Feeding System - Force Development Test and Experimentation Test Report (CDEC-TR-85-006A) Vol I, II, III, January 1986

(2) Popper, R et al. Field Evaluation of Improved MRE, MRE VII and MRE IV. USANRDEC/USARIEM Tech Report TR-87/027, 1987.

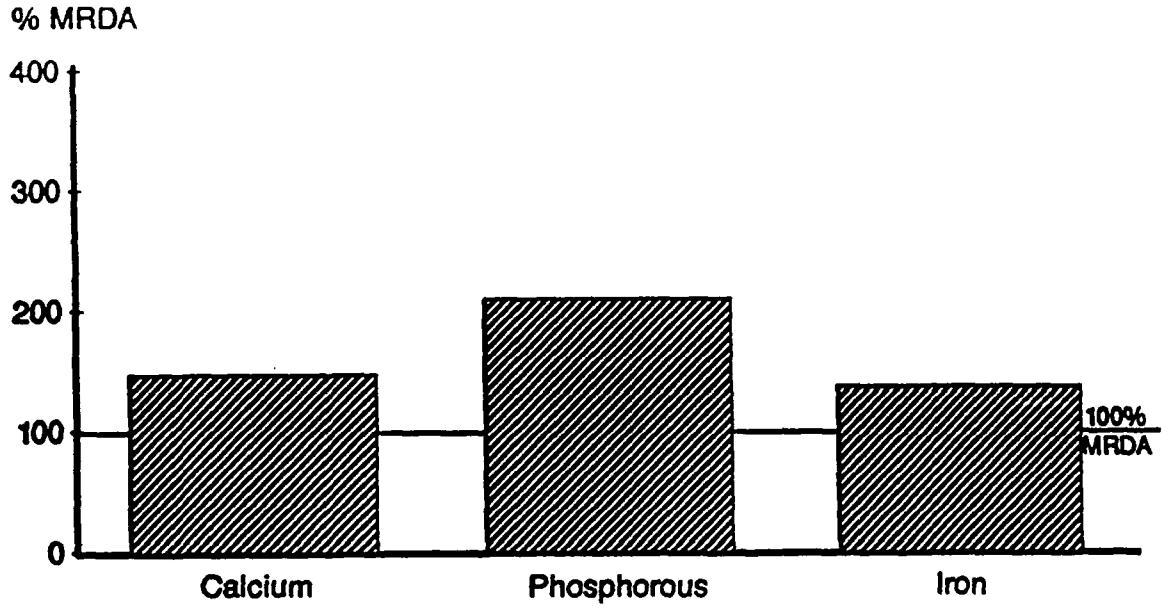
NUTRIENT INTAKES IN ARMY GARRISON DINING FACILITIES

Nutrient Intakes*

Nutrient	Mean	MRDA
Energy (KCAL)	3125	2800-3600
CHO (% Total Kcal)	49%	50-55%
Protein (% Total Kcal)	15%	----
Fat (% Total KCAL)	37%	35% (MAX)

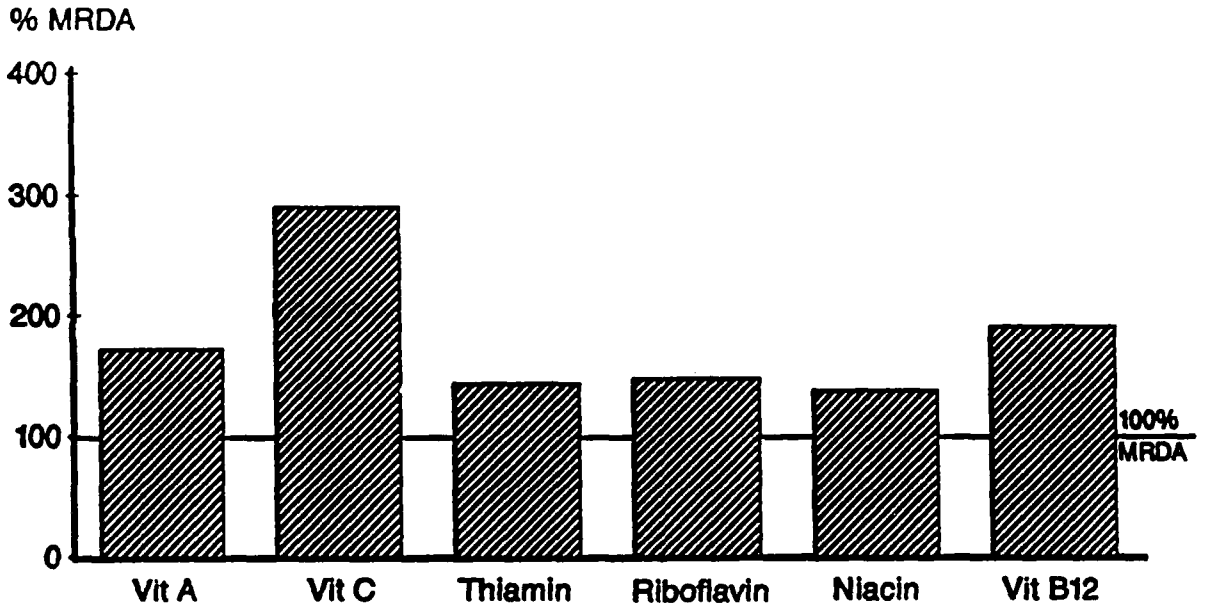
* From Ft. Riley, Ft. Lewis, Ft. Devens I & II, Ft. Jackson

Average Daily Mineral Intakes * Compared with MRDA Values



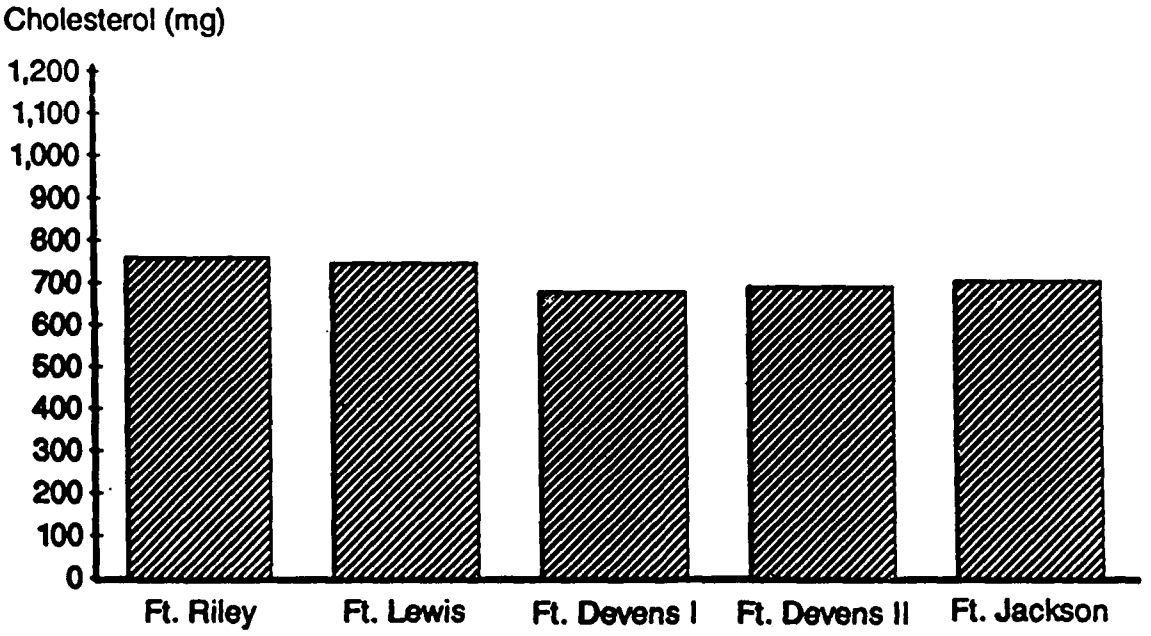
* Ft. Riley, Ft. Lewis, Ft. Devens I & II, Ft. Jackson

Average Daily Vitamin Intakes *
Compared with MRDA Values

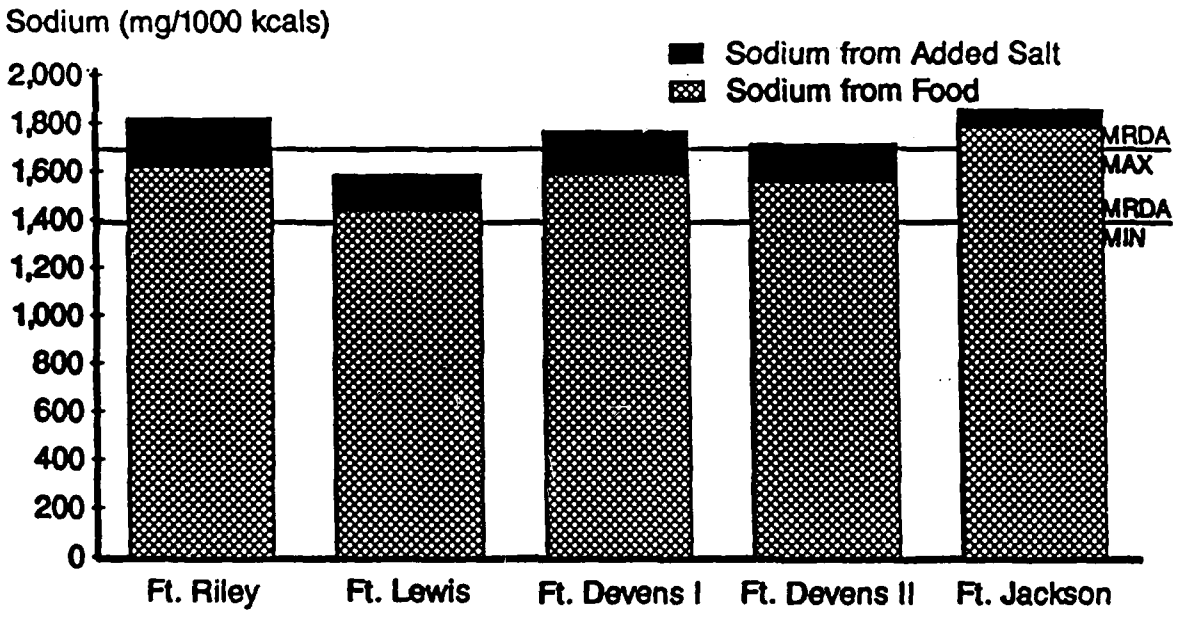


* Ft. Riley, Ft. Lewis, Ft. Devens I & II, Ft. Jackson

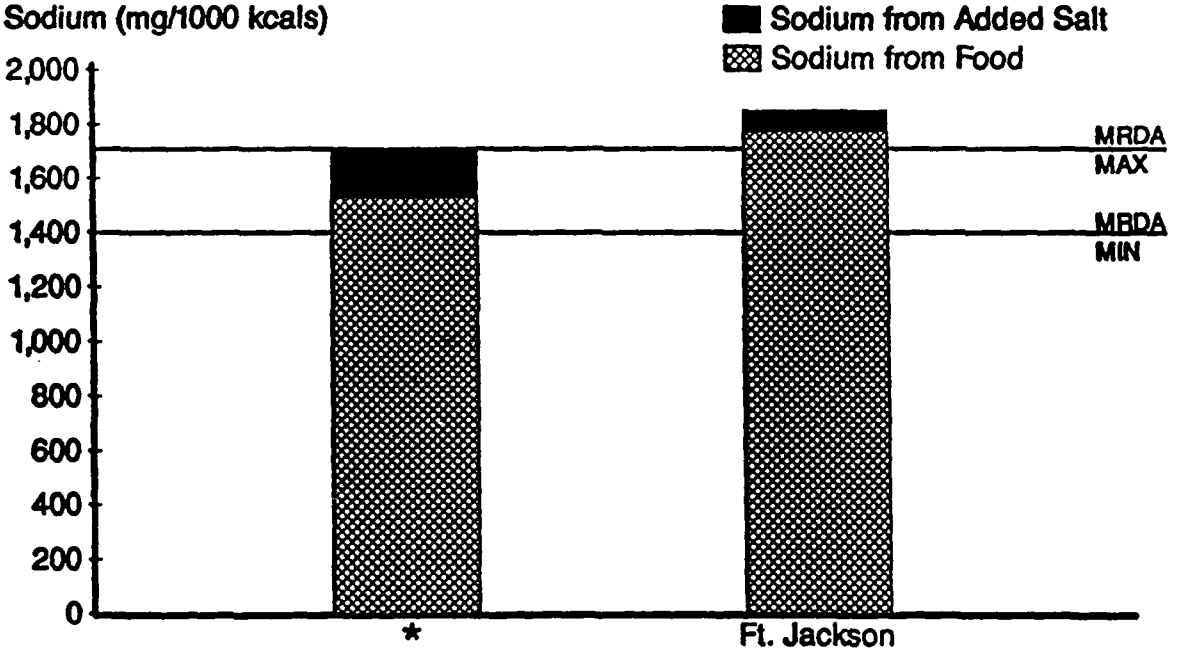
Average Cholesterol Intakes



Comparison of Average Sodium Intakes Per 1000 Calories

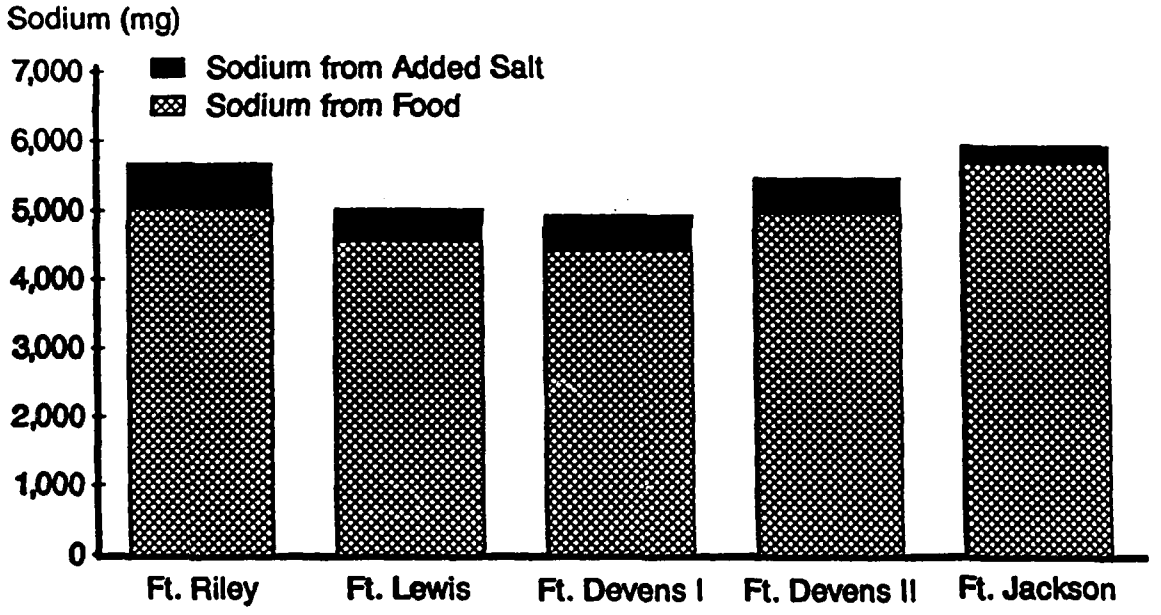


Average Sodium Intakes Per 1000 Calories

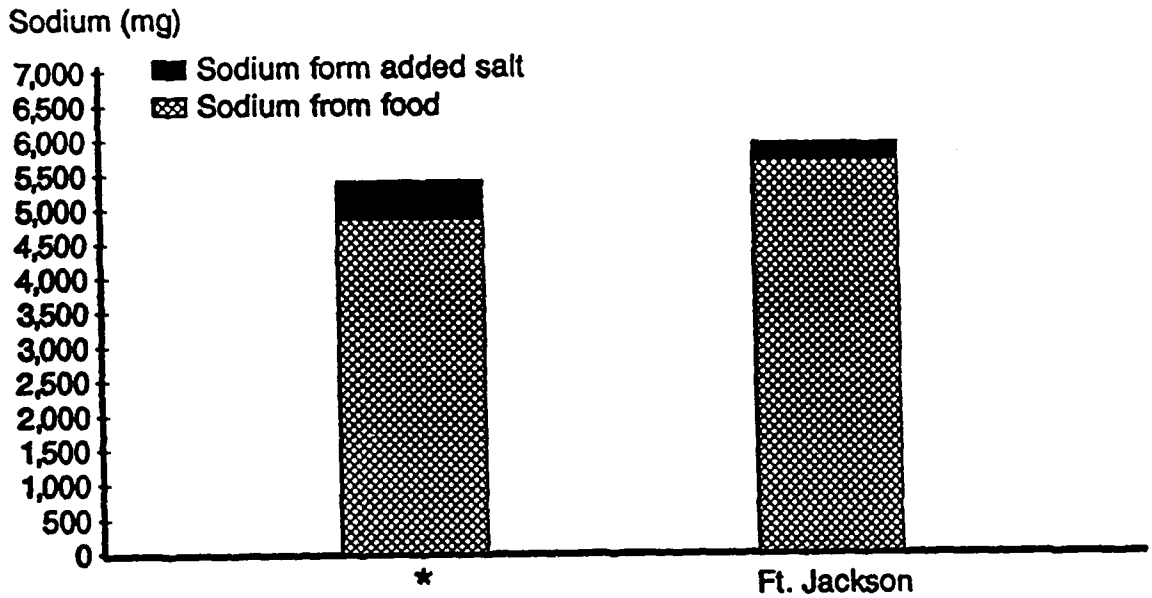


* Mean for Ft. Riley, Ft. Lewis, Ft. Devens I&II

Comparison of Average Sodium Intakes



Comparison of Average Sodium Intakes



* Mean of Ft. Riley, Ft. Lewis, Ft. Devens I & II

Combined Nutrient Intakes*

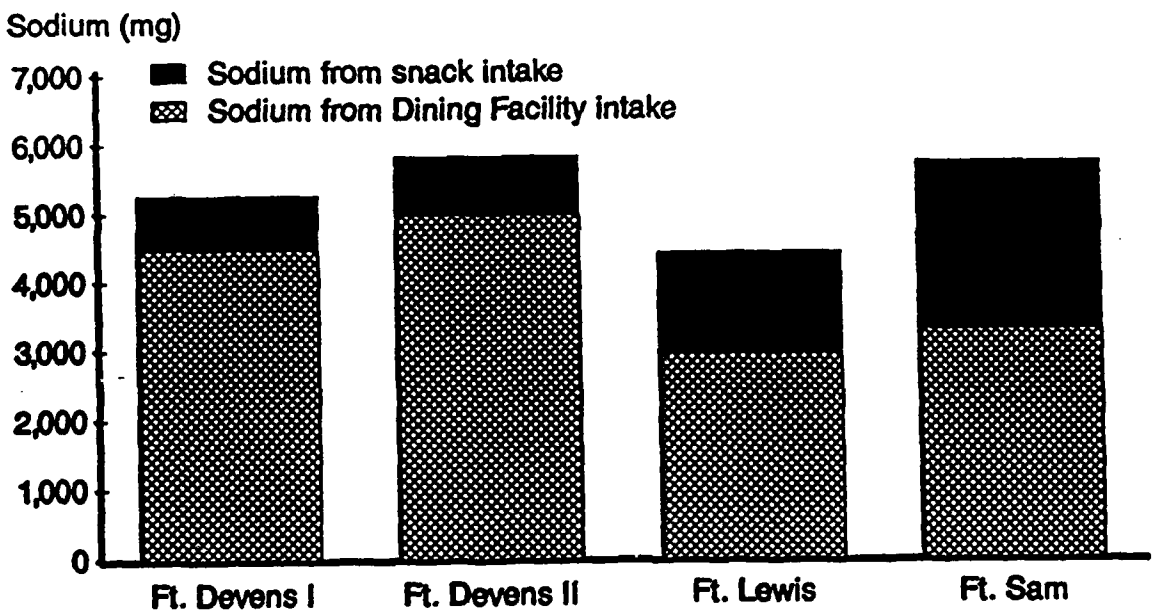
Nutrient	Fort Devens I	Fort Devens II	Fort Lewis	Fort Sam	MRDA
Energy (Kcal)	3650	3648	2908	2862	2800-3600
CHO (% of Total Kcal)	50	46	46	54	50-55%
Protein (% of Total Kcal)	13	15	15	13	----
Fat (% Total Kcal)	33	37	38	31	35 (MAX)

* Combination of Dining Facility and Snack Intakes

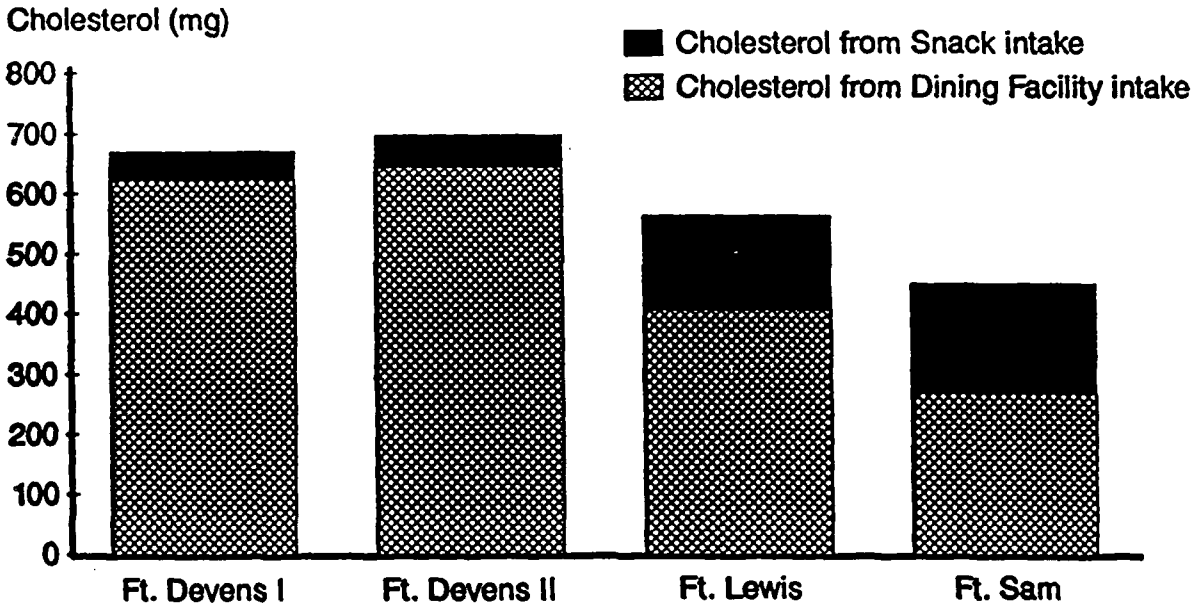
Snack Nutrient Intakes

Nutrient	Fort Devens I	Fort Devens II	Fort Lewis	Fort Sam	MRDA
Energy (Kcal)	925	768	1085	1324	N/A
(% of Total Energy)	25	21	37	46	
CHO (% of Kcal)	55	51	42	50	50-55%
Protein (% of Kcal)	7	8	12	11	—
Fat (% of Kcal)	20	26	36	29	35 (MAX)

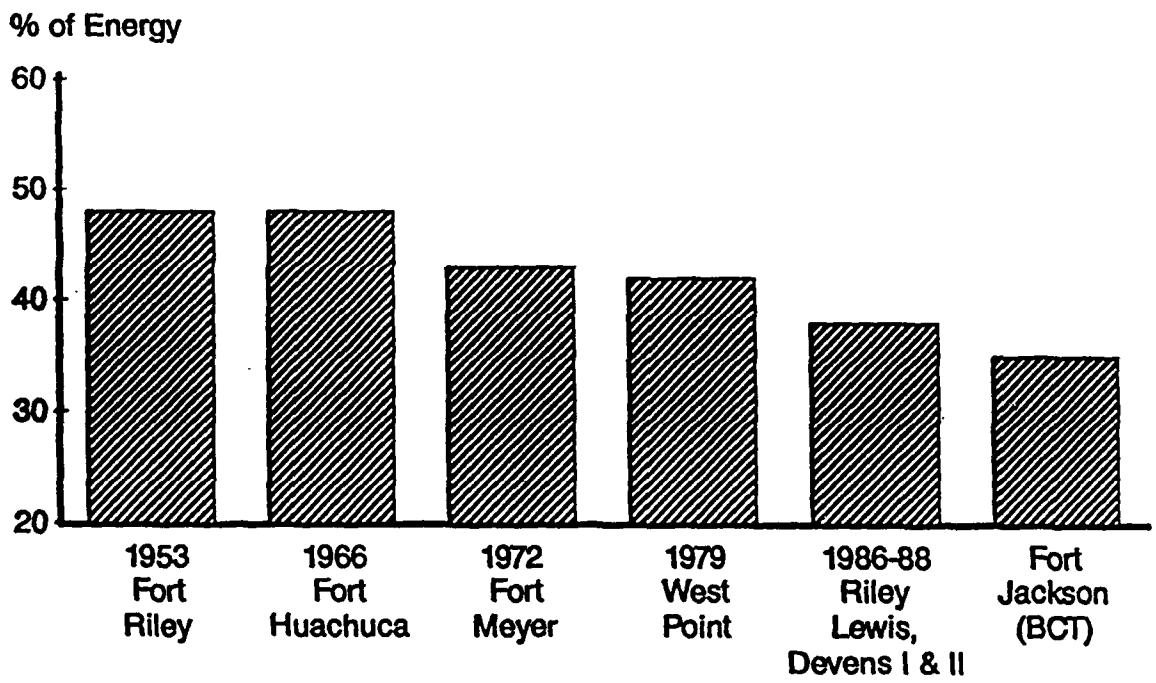
Comparison of Average Combined Sodium Intakes



Comparison of Average Combined Cholesterol Intakes



Trends in Army Dining Facilities
Percent of Energy from Fat



Executive Summary

DIET AND HEALTH

Implications for Reducing Chronic Disease Risk

NATIONAL RESEARCH COUNCIL

Executive Summary

DIET AND HEALTH

Implications for Reducing Chronic Disease Risk

Committee on Diet and Health
Food and Nutrition Board
Commission on Life Sciences
National Research Council

NATIONAL ACADEMY PRESS
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The study summarized in this publication was supported by funds from the National Research Council Fund, a pool of private, discretionary, nonfederal funds that is used to support a program of Academy-initiated studies of national issues in which science and technology figure significantly. The NRC Fund consists of contributions from a consortium of private foundations including Carnegie Corporation of New York, Charles E. Culpeper Foundation, William and Flora Hewlett Foundation, John D. and Catherine T. MacArthur Foundation, Andrew W. Mellon Foundation, Rockefeller Foundation, and Alfred P. Sloan Foundation; the Academy Industry Program, which seeks annual contributions from companies that are concerned with the health of U.S. science and technology and with public policy issues with technological content; and the National Academy of Sciences and National Academy of Engineering endowments. The study was also supported by W.K. Kellogg Foundation, The Henry J. Kaiser Family Foundation, Pew Charitable Trusts, Fannie E. Rippel Foundation, and Occidental Petroleum Corporation.

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This Executive Summary is available in limited quantities from the Food and Nutrition Board, 2101 Constitution Avenue, NW, Washington, DC 20418.

The complete volume of *Diet and Health: Implications for Reducing Chronic Disease Risk*, from which this Executive Summary is extracted, will be available Summer 1989 for sale from the National Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418.

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Preface

In the first half of the twentieth century, research in human nutrition was concerned primarily with the role of essential nutrients, particularly vitamins, in human deficiency diseases. It was not until the end of World War II that nutrition research in human populations in the United States focused on the role of diet in chronic diseases, such as coronary heart disease and cancer. The link forged by these later epidemiologic studies was strengthened by complementary evidence from laboratory studies. In the last decade, the wealth of information provided by these studies has been used by U.S. government agencies and other expert groups to propose dietary guidelines aimed at reducing the risk of one or more chronic diseases among North Americans.

Although there has been increasing consensus among various groups on many of the dietary guidelines, there remains a lack of agreement on several specific points. Our incomplete knowledge about the multiple environmental and genetic factors that determine chronic disease risk, specifically dietary and nutritional risk factors, the imprecision in methods for assessing nutrient and dietary status, and the differences among target groups and the objectives of recommendations proposed by many expert groups have all contributed to the variability in dietary guidelines. Furthermore, there has been insufficient documentation of the scientific bases underlying the conclusions and recommendations and the criteria used to derive them.

In recent years, the public has been confronted with a plethora of information on diet and its association with chronic diseases without guidance on how to separate fact from fallacy. The National Research Council's Food and Nutrition Board in the Commission on Life Sciences recognized this dilemma and the need to address the important issue of the role of diet in the etiology and prevention of the major causes of morbidity and mortality in the United States. In 1984, the Board established the Committee on Diet and Health to undertake a comprehensive analysis of the scientific literature on diet and the spectrum of major chronic diseases and to evaluate the criteria used to assess the strength of the evidence on associations of diet with health. This report is the result of this critical and detailed analysis and is the first of a systematic series of reports to be issued in a pattern similar to the Board's *Recommended Dietary Allowances* (RDAs)—a periodic review that provides guidelines on the desirable amounts of essential nutrients in the diet.

The three major objectives of this study were:

- to develop criteria for systematically evaluating the scientific evidence relating dietary components, foods, food groups, and dietary patterns to the maintenance of health and to the reduction of risk of chronic disease;

- to use these criteria to assess the scientific evidence relating these same factors (dietary components, foods, food groups, and dietary patterns) to health and to the reduction of chronic disease risk; and
- on the basis of this assessment, to propose dietary guidelines for maintaining health and reducing chronic disease risk, to suggest directions for future research, and to provide the basis for periodic updates of the literature and guidelines as new information on diet and health is acquired.

The 19-member interdisciplinary committee appointed to conduct the study was assisted by one adviser and two Food and Nutrition Board liaison members. Collectively, the Committee on Diet and Health included expertise in such disciplines as biochemistry, biostatistics, clinical medicine, epidemiology, foods and food consumption patterns, human genetics, metabolism, various aspects of nutrition, public health, and toxicology. During the course of the study, the committee examined data on the association between diet, health, and chronic disease, focusing on coronary heart disease, peripheral arterial disease, stroke, hypertension, cancer, obesity, osteoporosis, diabetes mellitus, hepatobiliary disease, and dental caries. Whenever possible, the committee looked directly at primary sources of data contained in the literature. Works of other evaluative bodies, for example, the *Surgeon General's Report on Nutrition and Health* published in 1988 and *Dietary Guidelines for Americans* published in 1985 by the Departments of Agriculture and Health and Human Services, were important secondary sources of information. By drawing from the vast and diverse epidemiologic and laboratory data base, the committee has attempted to ensure a comprehensive and critical review. Thus, the conclusions and recommendations throughout this report are supported by a detailed discussion of the basis underlying them.

The committee held 13 meetings during which it evaluated the literature and prepared its general review and summary. A public meeting convened at the outset of the study served as a forum for open discussion and presentation of views and information by the public and by representatives of the food industry, consumer groups, and scientists.

In the early stages of the study, the committee conducted five workshops during which it interacted with and shared the expertise and research findings of a larger community of scientists. These workshops provided committee members an opportunity to consider new or controversial data and all valid scientific points of view and to identify gaps in knowledge. The subjects considered in the workshops included the role of vitamins, minerals, and trace elements in chronic disease risk; the importance of genetic factors in selected diet-related chronic diseases; the association of energy, fiber, and carbohydrates with chronic disease; pediatric diet and the risk of adult chronic disease; and criteria for formulating dietary guidelines.

The committee's report is presented in four parts. Part I (Introduction, Definitions, and Methodology) offers four introductory chapters in addition to the Executive Summary (Chapter 1). These chapters highlight the methods and criteria used by the committee as well as the major conclusions and dietary recommendations, their bases, and their implications. Chapter 2 presents the criteria for evaluating the evidence linking diet and chronic disease. The strengths and weaknesses of methodologies for assessing dietary intake as well as those of specific kinds of studies (both human and animal) designed to assess diet–health relationships are reviewed. Trends in, and assessment of, food consumption patterns and the nutritional status of the U.S. population are discussed in Chapter 3. In Chapter 4, the committee discusses the role of genetics in nutrition and how genetic and environmental factors interact to influence diet-associated risks of chronic disease. Chapter 5 presents the rationale for selecting the major diet-related chronic diseases addressed in this report and provides an overview of the extent and distribution of those diseases in the United States. In Part II of this report (Evidence on Dietary Components and Chronic Diseases), the criteria described in Chapter 2 provide the basis of a review of the evidence by *nutrients*. The 13 chapters in that section (6 through 18) summarize the epidemiologic, clinical, and laboratory data pertaining to each nutrient or dietary factor and the chronic diseases identified by the committee. Nutrient interactions and mechanisms of action are discussed where applicable. Part III (Impact of Dietary Patterns on Chronic Diseases) briefly reassembles the evidence relating nutrients to specific chronic diseases or conditions and comments on the importance of diet relative to nondietary risk factors in the etiology of those diseases. Part IV (Overall Assessment, Conclusions, and Recommendations) contains two chapters. Chapter 27 presents the committee's conclusions, along with a summary of the process, criteria, and scientific bases underlying them. Chapter 28 presents the

committee's dietary recommendations and the rationales for each, as well as a detailed discussion of how the recommendations compare to those issued in the past by other expert groups and the bases for similarities and dissimilarities among these. Also contained in this section is an in-depth discussion of the potential risks and public health benefits of the committee's dietary recommendations.

The committee hopes this report will be a useful resource document for scientists in academia and industry, for the general public, and for policymakers. Furthermore, it believes that the nine dietary recommendations presented in Chapter 28 and in the Executive Summary (Chapter 1) can be implemented within the framework of the current U.S. lifestyle. Collaboration among government agencies, the food industry, health professionals (physicians, nutritionists, dietitians, and public health personnel), educational institutions, leaders in mass media, and the general public is encouraged to attain this goal.

The committee greatly appreciates the hard work and organization provided by the Food and Nutrition Board staff headed by Dr. Sushma Palmer and consisting of Drs. Christopher Howson, Farid Ahmed, and Susan Berkow, Mrs. Frances Peter, Mr. Aldon Griffis, Ms. Marian Millstone, Ms. Dorothy Majewski, Ms. Avis Harris, Ms. Michelle Smith, and Mrs. Elsie Sturgis.

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Chairman
Committee on Diet and Health

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Executive Summary

The twentieth century has witnessed noticeable shifts in the direction of nutrition programs, policy, and research in industrialized nations—from identification and prevention of nutrient deficiency diseases in the first three decades of the century to refinement and application of knowledge of nutrient requirements in the subsequent two decades. In the second half of the century, emphasis on nutrient deficiency diseases decreased as the major causes of mortality shifted from infectious to chronic diseases. Attention then turned to investigating the role of diet in the maintenance of health and the reduction of the risk of such chronic diseases as heart disease and cancer. Subsequently, epidemiologic, clinical, and laboratory research demonstrated that diet is one of the many important factors involved in the etiology of these diseases. During the past few decades, scientists have been faced with the challenge of identifying dietary factors that influence specific diseases and defining their pathophysiological mechanisms. Simultaneously, public health policymakers, the food industry, consumer groups, and others have been debating how much and what kind of evidence justifies giving dietary advice to the public and how best to mitigate risk factors on which there is general agreement among scientists.

PURPOSE, APPROACH, AND SCOPE OF THE STUDY

This study on diet, chronic diseases, and health was launched in an effort to address the scientific issues that are fundamental to nutrition policy on reducing the risk of these diseases. The Committee on Diet and Health was appointed to conduct the study within the Food and Nutrition Board of the National Research Council's Commission on Life Sciences. The committee began with the understanding that lack of consensus on the role of diet in the etiology of chronic diseases derived partly from incomplete knowledge and partly from the absence of generally accepted criteria for interpreting the evidence. It also noted that the totality of the evidence relating dietary components to the entire spectrum of major chronic diseases had yet to be examined systematically. Several reports issued to date have addressed many issues of public health importance. However, most have not been sufficiently comprehensive and have not crossed the boundary separating the simple assessment of dietary risk factors for single chronic diseases from the complex task of determining how these risk factors influence the entire spectrum of chronic diseases—atherosclerotic cardiovascular diseases, cancer, diabetes, obesity, osteoporosis, dental caries, and chronic liver and kidney diseases.

This report attempts to cross that boundary. It complements the recent *Surgeon General's Report on Nutrition and Health* and other efforts of government agencies and voluntary health and scientific organizations by providing an in-depth analysis of the overall relationship between diet and the full spectrum of major chronic diseases.

In this report, the committee reviews the evidence regarding all major chronic public health conditions that diet is believed to influence. It draws conclusions about the effects of nutrients, foods, and dietary patterns on health, proposes dietary recommendations that have the potential for diminishing risk, and estimates their public health impact.

The committee focuses on risk reduction rather than on management of clinically manifest disease. It recognizes, however, that the distinction between *prevention* or *risk reduction* and *treatment* may be blurred in conditions where dietary modification might delay the onset of clinical diseases (e.g., the cardiovascular complications in diabetes mellitus) or might slow the progression of impaired function; therefore, conditions such as these are addressed, but only briefly. The committee defined risk reduction broadly to include decreased morbidity as well as mortality from chronic diseases and believes that consideration should be given to dietary modification to reduce the risk for both. The difficulty of quantifying the role of diet in the etiology of chronic diseases and the potential public health impact of dietary modification are discussed in Chapters 2 and 28.

In Chapter 2, the committee presents criteria for assessing the data from single studies and explains its procedure for evaluating the overall evidence. Special attention is given to the role of nutrient interactions and to the assessment of benefits and risks in arriving at conclusions and formulating dietary recommendations. Throughout the report, the committee recognizes that genetically dependent variability among individuals, and variability due to age, sex, and physiological status, may all affect physiological requirements for nutrients, responses to dietary exposures, the risk of chronic diseases, and consequently the effectiveness of dietary recommendations in reducing the risk of chronic diseases. The report addresses in detail the risks that apply to the general population and comments on the feasibility of defining risks for subpopulations and individuals with different susceptibilities. Finally, the committee discusses the limitations of data on diet-disease relationships, emphasizes the necessarily interim nature of its conclusions and recommendations, and proposes directions for research.

CRITERIA FOR ASSESSMENT

The strengths and weaknesses of different kinds of clinical, epidemiologic, and laboratory studies and the methodologies for dietary assessment are reviewed in Chapter 2. To the extent possible, the committee evaluated data from studies in humans as well as in animals. It noted that ecological correlations of dietary factors and chronic diseases among human populations provide valuable data but cannot be used alone to estimate the strength of the association between diet and diseases. The effect of diet on chronic diseases has been most consistently demonstrated in comparisons of populations with substantially different dietary practices, possibly because it is more difficult to identify such associations within a population whose diet is fairly homogeneous. Thus in general, associations within populations based on case-control and prospective cohort studies underestimate the association. In intervention studies, long exposure is usually required for the effect of diet on chronic disease risk to be manifested. Furthermore, the strict criteria for selecting participants in such studies may result in more homogeneous study samples, which limit the applicability of results to the general population. Despite the limitations of various types of studies in humans, the committee concluded that repeated and consistent findings of an association between certain dietary factors and diseases are likely to be real and indicative of a cause-and-effect relationship.

Experiments on dietary exposure of different animal strains can take genetic variability into account and permit more intensive observation. However, extrapolation of data from animal studies to humans is limited by the ability of animal models to simulate human diseases and the comparability of absorption and metabolic phenomena among species. The committee placed more confidence in data derived from studies on more than one animal species or test system, on results that have been reproduced in different laboratories, and on data that indicate a dose-response relationship.

The committee concluded that assessments of the strength of associations between diet and chronic diseases cannot simply be governed by criteria commonly used for inferring causality in other areas of human health. Faced with the special characteristics of studies on nutrients, dietary patterns, and chronic diseases, the commit-

tee first assessed the strengths and weaknesses of each kind of study and then evaluated the total evidence against six criteria: strength of association, dose-response relationship, temporally correct association, consistency of association, specificity of association, and biologic plausibility. Finally, it assessed the overall strength of the evidence on a continuum from highly likely to very inconclusive. Overall, the strength, consistency, and preponderance of data and the degree of concordance in epidemiologic, clinical, and laboratory evidence determined the strength of the conclusions in this report.

Integration of the Overall Evidence

In Section II of this report, Evidence on Dietary Components and Chronic Diseases (Chapters 6 through 18), the committee uses the approach described briefly above and more fully in Chapter 2. Throughout this section, the committee considers the epidemiologic, clinical, and experimental data pertaining to each nutrient or dietary factor and specific chronic diseases, including cardiovascular diseases, specific cancers, diabetes, hypertension, obesity, osteoporosis, hepatobiliary disease, and dental caries. Nutrient interactions and mechanisms of action are discussed where applicable.

In Section III, Impact of Dietary Patterns on Chronic Diseases, the evidence relating nutrients to specific chronic diseases and diet-related conditions is briefly reassembled and leads to the committee's conclusions on the role of dietary patterns in the etiology of the diseases and assessment of the potential for reducing their frequency and severity. These conclusions are drawn directly from the research data, where the evidence pertains to dietary patterns or foods and food groups, or from extrapolations from the evidence on individual nutrients. In its overall review and integration of the evidence, the committee moved from a consideration of individual nutrients to foods, to food groups, and then to dietary patterns as they relate to the spectrum of chronic diseases.

CRITERIA AND PROCESS FOR FORMULATING DIETARY RECOMMENDATIONS

Absolute proof is difficult to obtain in any branch of science. As evidence accumulates, however, it often reaches the point of proof in an operational sense, even though proof in an absolute sense may be lacking. In law, proof beyond a reasonable doubt is generally accepted as a standard for making decisions and taking action. The degree of evidence as well as the severity of the crime are the bases for the relative intrusiveness of legal actions taken, e.g., issuing a warning for a misdemeanor compared to the imposition of severe penalties for a felony.

A similar paradigm can be applied to evidence on dietary patterns and associated health risks. For example, public education might be sufficient to warn against the potential hazard of excess caffeine intake, whereas evidence on the toxicity and carcinogenicity of aflatoxin warrants government regulation to curtail aflatoxin contamination of grains and milk. The strength of the evidence might not be the only relevant criterion for determining the course of action; other factors include the likelihood and severity of an adverse effect, potential benefits of avoiding the hazard, and the feasibility of reducing exposure.

Much remains to be learned about the impact of diet on chronic disease risk. Nonetheless, in accordance with this paradigm, the committee concluded that the overall evidence regarding a relationship between certain dietary patterns (e.g., a diet high in total fat and saturated fat) and chronic diseases (e.g., cardiovascular diseases and certain cancers) supports (1) a comprehensive effort to inform the public about the likelihood of certain risks and the possible benefits of dietary modification and (2) the use of technological and other means (e.g., production of leaner animal products) to facilitate dietary change.

Assessing Risks and Benefits

The committee hopes to contribute to knowledge about the process of arriving at dietary recommendations by documenting the considerations and the logic that underlie its dietary recommendations. An essential step in developing dietary recommendations for overall health maintenance is the synthesis of recommendations pertaining to single diseases into a single coherent set of recommendations to reduce the overall risk of diet-related chronic diseases. For example, recommendations to enhance calcium intake for possible protection against osteoporosis might, in isolation, be viewed as conflicting with recommendations for coronary heart disease, because dairy products—which contribute the most calcium to the U.S. diet—are also rich sources of saturated fats, which increase coronary heart disease risk. Thus,

recommendations for maintaining adequate bone mass as well as for preventing coronary disease would logically stress consumption of low-fat dairy products.

The committee also considered the synergistic and antagonistic effects of dietary interactions. For example, the potential benefits of encouraging adequate trace element intake for reducing the risk of certain cancers could in principle be offset by a recommendation to increase vegetable intake for the possible prevention of colon cancer, because high plant food diets are also high in fiber, which could initially inhibit absorption of certain trace elements. To a large extent, the task of assessing such potential competing risks and benefits and nutrient interactions was simplified by an inherent consistency in dietary recommendations to maintain good health. For example, the advisability of consuming a diet low in saturated fatty acids, total fat, and cholesterol is supported by strong evidence of potential benefit in reducing the risk of cardiovascular diseases as well as comparatively weaker evidence that low-fat diets decrease the risk of certain kinds of cancers.

Other Considerations

The committee also considered whether to base recommendations on individual nutrients, on single foods or food groups, or on overall pattern of dietary intake. Although recommendations based on nutrients or food groups are of value, in the committee's experience guidelines directed toward overall dietary patterns are the most useful because they address the total diet and are more easily interpreted by the general public. Moreover, because many studies on diet and chronic diseases in humans have focused on foods rather than on single nutrients, food-based recommendations may more accurately reflect current understanding about the relationship between chronic diseases and diet. Nonetheless, many of the diet-disease relationships examined required consideration of single foods, food groups, and specific nutrients. This is reflected in the committee's recommendations.

The committee agreed that quantitative guidelines should be proposed when warranted by the strength of the evidence and the potential importance of recommendations to public health. Such guidelines can take into account nutrient interactions, they are less susceptible to misinterpretation when translated into food choices, and they provide specific targets that can serve as a basis for nutrition programs and policy. The committee has attempted to explain the degree of certainty warranted by the evidence and to make quantitative recommendations to the extent justified.

Recommendations for Individuals as Opposed to Populations

There are two complementary approaches to reducing risk factors in the target population. The first, the public health or population-based approach, is aimed at the general population, and the second, the high-risk or individual-based approach, is aimed at individuals with defined risk profiles. Most chronic diseases etiologically associated with nutritional factors (e.g., atherosclerotic cardiovascular diseases, hypertension, obesity, many cancers, osteoporosis, and diabetes mellitus) also have genetic determinants, and genetic-environmental interactions play an important role in determining disease outcome. For most diseases, however, it is not yet possible to identify susceptible genotypes and thus risks to specific individuals. Furthermore, the variability in nutrient requirements among individuals is not well defined. Therefore, it is usually not possible to make recommendations for individuals. On the other hand, because the major chronic disease burden falls on the general population (approximately 70% of all deaths in the U.S. population are due to cardiovascular diseases and cancer), the most benefit is likely to be achieved by a public-health prevention strategy to shift the distribution of dietary risk factors by means of dietary recommendations to reduce chronic disease risk in the general population.

The public health approach to prevention recognizes that even though reduction of risk for individuals with average risk profiles (e.g., an average serum cholesterol level) might be small or negligible, because these people represent the great majority of the population, the benefit for the total population is likely to be paradoxically large (e.g., because most coronary deaths occur among those who have only moderate elevations in serum cholesterol levels). However, when it is possible to identify high-risk persons, such as those with certain hyperlipidemias, special attention can be directed to their management. Therefore, in the committee's judgment, an effective prevention strategy should be aimed at the general public and, where knowledge permits, it should be complemented with recommendations for those at high risk.

MAJOR CONCLUSIONS AND THEIR BASES

The committee analyzed trends in the major chronic diseases as well as in eating patterns (Chapters 3 and 5). It reviewed the epidemiologic, clinical, and laboratory evidence pertaining to dietary factors and chronic diseases (Chapters 6 through 26) and attempted to put into perspective the role of diet as it relates to other environmental and genetic factors in the etiology of these diseases (Chapters 4 and 5).

Following are the general conclusions drawn from the committee's in-depth review, as well as the specific conclusions pertaining to the major dietary components and specific chronic diseases.

General Conclusions

- A comprehensive review of the epidemiologic, clinical, and laboratory evidence indicates that diet influences the risk of several major chronic diseases. The evidence is very strong for atherosclerotic cardiovascular diseases and hypertension and is highly suggestive for certain forms of cancer (especially cancers of the esophagus, stomach, large bowel, breast, lung, and prostate). Furthermore, certain dietary patterns predispose to dental caries and chronic liver disease, and a positive energy balance produces obesity and increases the risk of noninsulin-dependent diabetes mellitus. However, the evidence is not sufficient for drawing conclusions about the influence of dietary patterns on osteoporosis and chronic renal disease.
- Most chronic diseases in which nutritional factors play a role also have genetic and other environmental determinants, but not all the environmental risk factors have been clearly characterized and susceptible genotypes usually have not been identified. Furthermore, the mechanisms of genetic and environmental interactions involved in disease are not fully understood. It is evident that dietary patterns are important factors in the etiology of several major chronic diseases and that dietary modifications can reduce such risks. Nevertheless, for most diseases, it is not yet possible to provide quantitative estimates of the overall risks and benefits.

Fats, Other Lipids, and High-Fat Diets

The following conclusions derive from the committee's extensive review of the data described in Chapters 6 (Calories), 7 (Fats and Other Lipids), 19 (Atherosclerotic Cardiovascular Diseases), 21 (Obesity and Eating Disorders), 22 (Cancer), and 25 (Hepatobiliary Disease).

General Conclusion

- There is clear evidence that the total amounts and types of fats and other lipids in the diet influence the risk of atherosclerotic cardiovascular diseases and, to a less well-established extent, certain forms of cancer and possibly obesity. The evidence that the intake of saturated fatty acids and cholesterol are causally related to atherosclerotic cardiovascular diseases is especially strong and convincing.

Total Fats

- In several types of epidemiologic studies, a high-fat intake is associated with increased risk of certain cancers, especially cancers of the colon, prostate, and breast. The epidemiologic evidence is not totally consistent, but it is supported by experiments in animals. The combined epidemiologic and laboratory evidence suggests that a reduction of total fat intake is likely to decrease the risk of these cancers.
- High-fat intake is associated with the development of obesity in animals and possibly in humans. In short-term clinical studies, a marked reduction in the percentage of calories derived from dietary fat has been associated with weight loss.
- Although gallbladder disease is associated with obesity, there is no conclusive evidence that it is associated with fat intake.
- Intake of total fat per se, independent of the relative content of the different types of fatty acids, is not associated with high blood cholesterol levels and coronary heart disease. A reduction in total fat consumption, however, facilitates reduction of saturated fatty acid intake; hence, in addition to reducing the risk of certain cancers, and possibly obesity, it is a rational part of a program aimed at reducing the risk of coronary heart disease.

Saturated Fatty Acids

- Clinical, animal, and epidemiologic studies demonstrate that increased intakes of saturated fatty acids (12 to 16 carbon atoms in length) increase the levels of serum total and low-density-lipoprotein (LDL) cholesterol and that these higher levels in turn lead to atherosclerosis and increase the risk of coronary heart disease. Satu-

rated fatty acid intake is the major dietary determinant of the serum total cholesterol and LDL cholesterol levels in populations and thereby of coronary heart disease risk in populations. Lowering saturated fatty acid intake is likely to reduce serum total and LDL cholesterol levels and, consequently, coronary heart disease risk.

- The few epidemiologic studies on dietary fat and cancer that have distinguished between the effects of specific types of fat indicate that higher intakes of saturated fat as well as total fats are associated with a higher incidence of and mortality from cancers of the colon, prostate, and breast. In general, these findings are supported by data from animal experiments.

Polyunsaturated Fatty Acids

- Clinical and animal studies provide firm evidence that omega-6 polyunsaturated fatty acids when substituted for saturated fatty acids result in a lowering of serum total cholesterol and LDL cholesterol and usually also some lowering of high-density-lipoprotein (HDL) cholesterol levels.
- Laboratory studies in rodents suggest that diets with high levels of vegetable oils containing omega-6 polvunsaturated fatty acids promote certain cancers more effectively than diets with high levels of saturated fats, whereas there is some evidence that diets with a high content of omega-3 polyunsaturated fatty acids may inhibit these same cancers. However, these findings are not supported by the limited number of epidemiologic studies that have distinguished between the effects of different types of fat. There are no human diets that naturally have very high levels of total polyunsaturated fatty acids, and there is no information about the long-term consequences of high polyunsaturated fatty acid intakes.
- Fish oils containing large amounts of omega-3 polyunsaturated fatty acids reduce plasma triglyceride levels and increase blood clotting time. Their effects on LDL cholesterol vary, and data on the long-term health effects of large doses of omega-3 polyunsaturated fatty acids are limited. Limited epidemiologic data suggest that consumption of one or two servings of fish per week is associated with a lower coronary heart disease risk, but the evidence is not sufficient to ascertain whether the association is causal or related to the omega-3 polyunsaturated fatty acid content of fish.

Monounsaturated Fatty Acids

- Clinical studies indicate that substitution of monounsaturated for saturated fatty acids results in a reduction of serum total cholesterol and LDL cholesterol without a reduction in HDL cholesterol.

Dietary Cholesterol

- Clinical, animal, and epidemiologic studies indicate that dietary cholesterol raises serum total cholesterol and LDL cholesterol levels and increases the risk of atherosclerosis and coronary heart disease. There is substantial inter- and intra-individual variability in this response. High dietary cholesterol clearly seems to contribute to the development of atherosclerosis and increased coronary heart disease risk in the population.

Trans *Fatty Acids*

- Clinical studies indicate that *trans* fatty acids and their *cis* isomers have similar effects on plasma lipids. Animal studies do not indicate that *trans* fatty acids have a greater tumor-promoting effect than their *cis* isomers.

Carbohydrates, Vegetables, Fruits, Grains, Legumes, and Cereals and Their Constituents

The committee's conclusions on carbohydrates and foods containing complex carbohydrates—i.e., vegetables, fruits, grains, legumes, and cereal products—derive from a review of direct and indirect evidence throughout the report, especially in Chapters 9 (Carbohydrates), 10 (Dietary Fiber), 11 (Fat-Soluble Vitamins), 12 (Water-Soluble Vitamins), and 22 (Cancer).

- Diets high in plant foods—i.e., fruits, vegetables, legumes, and whole-grain cereals—are associated with a lower occurrence of coronary heart disease and cancers of the lung, colon, esophagus, and stomach. Although the mechanisms underlying these effects are not fully understood, the inverse association with coronary heart disease may be largely explained by the usually low saturated fatty acid and cholesterol content of such diets. Such diets are also low in total fat, which is directly associated with the risk of certain cancers, but rich in complex carbohydrates (starches and fiber) and certain vitamins, minerals, trace elements, and nonnutritive constituents, and these factors probably also confer protection against certain cancers and coronary heart disease.
- Compared to nonvegetarians, complete vegetarians and lacto-ovovegetarians have lower serum levels of total and LDL cholesterol and triglycerides. These lower levels may be the combined

result of lower intakes of saturated fatty acids and total fat and higher intakes of water-soluble fiber (e.g., pectin and oat bran). In clinical and animal studies, such fiber has been found to produce small reductions in serum total cholesterol independently of the effect due to fat reduction.

- Populations consuming high-carbohydrate diets, which are high in plant foods, have a comparatively lower prevalence of noninsulin-dependent diabetes mellitus, possibly because of the higher proportion of complex carbohydrate intake and lower prevalence of obesity—a risk factor for noninsulin-dependent diabetes mellitus. In clinical studies, such diets have been shown to improve glucose tolerance and insulin sensitivity.
- Epidemiologic studies indicate that consumption of carotenoid-rich foods, and possibly serum carotene concentration, are inversely associated with the risk of lung cancer.
- Laboratory studies in animals strongly and consistently indicate that certain retinoids prevent, suppress, or retard the growth of chemically induced cancers at a number of sites, including the esophagus, pancreas, and colon, but especially the skin, breast, and bladder. However, most epidemiologic studies do not show an association between preformed vitamin A and cancer risk or a relationship between plasma retinol level and cancer risk.
- Epidemiologic studies suggest that vitamin C-containing foods such as citrus fruits and vegetables may offer protection against stomach cancer, and animal experiments indicate that vitamin C itself can protect against nitrosamine-induced stomach cancer. The evidence linking vitamin C or foods containing that vitamin to other cancer sites is more limited and less consistent.
- Some investigators have postulated that several other vitamins (notably vitamin E, folic acid, riboflavin, and vitamin B_{12}) may block the initiation or promotion of cancer, but the committee judged the evidence too limited to draw any conclusions.
- Epidemiologic and clinical studies indicate that a diet characterized by high-fiber foods may be associated with a lower risk of coronary heart disease, colon cancer, diabetes mellitus, diverticulosis, hypertension, or gallstone formation, but there is no conclusive evidence that it is dietary fiber, rather than the other components of vegetables, fruits, and cereal products, that reduces the risk of those diseases. Although soluble fibers can decrease serum cholesterol and glucose levels, and certain insoluble fibers inhibit chemically induced tumorigenesis, it is difficult to compare the effects of specific dietary fibers tested in the laboratory with the effects of fiber-containing foods or of other potentially protective substances present in these foods.
- Although human and animal studies indicate that all fermentable carbohydrates can cause dental caries, sucrose appears to be the most cariogenic. The cariogenicity of foods containing fermentable carbohydrates is influenced by the consistency and texture (e.g., stickiness) of the food as well as by the frequency and sequence of consumption. Sugar consumption (by those with an adequate diet) has not been established as a risk factor for any chronic disease other than dental caries in humans.

Protein and High-Protein Diets

Studies of the association of protein and high-protein diets with chronic diseases are reviewed in Chapters 8 (Protein), 13 (Minerals), 19 (Atherosclerotic Cardiovascular Diseases), 22 (Cancer), and 23 (Osteoporosis) and form the basis of the following major conclusions.

- In intercountry correlation studies, diets high in meat—a major source of animal protein—have a strong positive association with increased atherosclerotic coronary artery disease and certain cancers, notably breast and colon cancer. Such diets are often characterized by a high content of saturated fatty acids and cholesterol, which probably accounts for a large part of the association with coronary heart disease, and by a high content of total fat, which is directly associated with the risk of these cancers. However, these diets also tend to have low levels of plant foods, the consumption of which is inversely associated in epidemiologic and animal studies with the risk of heart disease and certain cancers. Total serum cholesterol can be reduced in people with high blood cholesterol by replacing animal foods in their diet with plant foods.
- High protein intake can lead to increased urinary calcium excretion. The impact of this finding on the development of osteoporosis in the general population is unclear.
- The data linking elevated intakes of animal protein to increased risk of hypertension and stroke are weak, and no plausible mechanisms have been posited for either effect.

Energy

The following conclusions are based on assessment of the roles of energy intake and expenditure

in chronic disease risk as described in Chapters 6 (Calories) and Chapter 21 (Obesity and Eating Disorders).

- Positive energy balance can result from increased energy intake, reduced energy expenditure, or both, and over the long term, can lead to obesity and its associated complications.
- Although data from clinical and animal studies demonstrate that overfeeding leads to obesity, increased body weight in cross-sectional and longitudinal population surveys of adults cannot be accounted for by increased energy intake. Thus, it is likely that obesity develops in adult life either because of reduced physical activity, or overfeeding, or both. Obesity is enhanced not only by this energy imbalance but also by a genetic predisposition to obesity and altered metabolic efficiency.
- Epidemiologic studies indicate that increased energy expenditure is inversely associated with the risk of coronary heart disease.
- Epidemiologic and clinical studies and some experiments in animals demonstrate that obesity is associated with an increased risk of noninsulin-dependent diabetes mellitus, hypertension, gallbladder disease, endometrial cancer, and osteoarthritis. It may also be associated with a higher risk of coronary heart disease and postmenopausal breast cancer.
- Studies in humans suggest that fat deposits in the abdominal region pose a higher risk of noninsulin-dependent diabetes mellitus, coronary heart disease, stroke, hypertension, and increased mortality than do fat deposits in the gluteal or femoral regions.
- Experience in long-term management of obesity indicates that neither frequent fluctuations in body weight nor extreme restrictions of food intake are desirable.
- Long-term follow-up studies indicate that extreme leanness is associated with increased mortality and that the causes of mortality are different from those associated with excess weight.
- The specific causes of obesity are not well known, although some obese people clearly consume more energy compared to people of normal weight, whereas others are very sedentary or may have increased metabolic efficiency. Compared to maintenance of stable weight, weight gain in adult life is associated with a greater risk of cardiovascular disease, noninsulin-dependent diabetes mellitus, hypertension, gallbladder disease, and endometrial cancer. Certain risk factors—e.g., high serum cholesterol, elevated serum glucose, and high blood pressure—can be curtailed by weight reduction in overweight adults.

Alcoholic Beverages

The extensive data on the health effects of alcohol consumption are examined in Chapters 16 (Alcohol), 19 (Atherosclerotic Cardiovascular Diseases), 20 (Hypertension), 22 (Cancer), and 25 (Hepatobiliary Disease). Following are the committee's major conclusions related to alcohol.

- When consumed in excess amounts, alcohol replaces essential nutrients including protein and micronutrients and can lead to multiple nutrient deficiencies.
- Sustained, heavy intake of alcoholic beverages leads to fatty liver, alcoholic hepatitis, and cirrhosis. It also increases the risk of cancers of the oral cavity, pharynx, esophagus, and larynx, especially in combination with cigarette smoking, because the effects on cancer risk are synergistic. There is some epidemiologic evidence that alcohol consumption is also associated with primary liver cancer and that moderate beer drinking is associated with rectal cancer. The association of alcohol consumption with increased risk of pancreatic or breast cancer is less clear.
- Excessive alcohol consumption is associated with an increased incidence of coronary heart disease, hypertension, stroke, and osteoporosis.
- Alcohol consumption during pregnancy can damage the fetus, cause low infant birth weight, and lead to fetal alcohol syndrome. No safe level of alcohol intake during pregnancy has been determined.

Salt and Related Compounds

The following conclusions derive from the evidence on salt and related compounds and their relation to chronic diseases. This evidence is reviewed in Chapters 15 (Electrolytes), 20 (Hypertension), and 22 (Cancer).

- Blood pressure levels are strongly and positively correlated with the habitual intake of salt. In populations with a sustained salt intake of 6 g or more per day, blood pressure rises with age and hypertension is frequent, whereas in populations consuming less than 4.5 g of salt per day, the age-related rise in blood pressure is slight or absent and the frequency of hypertension is uniformly low. Clinical studies demonstrate that once hypertension is established, it cannot always be fully

corrected by resumption of a moderately low (<4.5 g/day) salt intake.

- Although clinical and epidemiologic studies indicate that some people are more susceptible to salt-induced hypertension than others, there are no reliable markers to predict individual responses. Epidemiologic evidence suggests that blacks, people with a family history of hypertension, and all those over age 55 are at a higher risk of hypertension.
- Epidemiologic and animal studies indicate that the risk of stroke-related deaths is inversely related to potassium intake over the entire range of blood pressures, and the relationship appears to be dose dependent. The combination of a low-sodium, high-potassium intake is associated with the lowest blood pressure levels and the lowest frequency of stroke in individuals and populations. Although the effects of reducing sodium intake and increasing potassium intake would vary and may be small in some individuals, the estimated reduction in stroke-related mortality for the population is large.
- A high salt intake is associated with atrophic gastritis in epidemiologic and animal studies, and there is also epidemiologic evidence that a high salt intake and frequent consumption of salt-cured and salt-pickled foods is associated with an elevated incidence of gastric cancer. The specific causative agents in these foods have not been fully identified.

Minerals and Trace Elements

The conclusions listed below are based on a review of the evidence on calcium, magnesium, trace elements, and chronic diseases discussed in Chapters 13 (Minerals), 14 (Trace Elements), 20 (Hypertension), 22 (Cancer), and 23 (Osteoporosis).

- Epidemiologic, clinical, and animal studies suggest that sustained low calcium intake is associated with a high frequency of fractures in adults, but the role of dietary calcium in the development of osteoporosis and the potential benefits of calcium supplements—in amounts that exceed the Recommended Dietary Allowances (RDAs)—in decreasing the risk of osteoporosis are unclear.
- Some epidemiologic studies have shown an association between calcium intake and blood pressure, but a causal association between low calcium intake and high blood pressure has not been established.
- A few data from epidemiologic and animal studies suggest that a high calcium intake may protect against colon cancer, but the evidence is preliminary and inconclusive.
- Unequivocal evidence from epidemiologic and clinical studies indicates that fluoridation of drinking water supplies at a level of 1 ppm protects against dental caries. Such concentrations are not associated with any known adverse health effects, including cancer.
- Low selenium intake in epidemiologic and animal studies and low selenium levels in human sera have been associated with an increased risk of several cancers. Moreover, some studies in animals suggest that diets supplemented with large doses of selenium offer protection against certain cancers. These data should be extrapolated to humans with caution, however, because high doses of selenium can be toxic.
- The data on most trace elements examined in this report (e.g., copper and cadmium) are too limited or weak to permit any conclusions about their effects on chronic disease risk.

Dietary Supplements

Claims for the health benefits of dietary supplements have drawn substantial attention in recent decades. The committee has reached the following conclusion on the basis of the evidence reviewed in Chapter 18 (Dietary Supplements).

- A large percentage of people in the United States take dietary supplements, but not necessarily because of nutrient needs. The adverse effects of large doses of certain nutrients (e.g., vitamin A) are well documented. There are no documented reports that daily multiple vitamin-mineral supplements, equaling no more than the RDA for a particular nutrient, are either beneficial or harmful for the general population. The potential risks or benefits of the long-term use of small doses of supplements have not been systematically examined.

Coffee, Tea, and Other Nonnutritive Dietary Components

The following major conclusions pertaining to coffee, tea, and other nonnutritive dietary components are based on a review of the evidence in Chapter 17 (Coffee, Tea, and Other Nonnutritive Dietary Components).

- Coffee consumption has been associated with slight elevations in serum cholesterol in some epidemiologic studies. Epidemiologic evidence linking coffee consumption to the risk of coronary

heart disease and cancer in humans is weak and inconsistent.

- Tea drinking has not been associated with an increased risk of any chronic disease in humans.
- The use of such food additives as saccharin, butylated hydroxyanisole, and butylated hydroxytoluene does not appear to have contributed to the overall risk of cancer in humans. However, this lack of evidence may be due to the relatively recent use of many of these substances or to the inability of epidemiologic techniques to detect the effects of additives against the background of common cancers from other causes. The association between food additives and cancer is also complicated by the long latency period between initial exposure to a carcinogen and the subsequent development of cancer.
- A number of environmental contaminants (e.g., some organochlorine pesticides, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons) cause cancer in laboratory animals. The committee found no evidence to suggest that any of these compounds *individually* makes a major contribution to the risk of cancer in humans; however, the risks from simultaneous exposure to several compounds and the potential for adverse effects in occupationally exposed people have not been adequately investigated.
- Certain naturally occurring contaminants in food (e.g., aflatoxins and *N*-nitroso compounds) and nonnutritive constituents (e.g., hydrazines in mushrooms) are carcinogenic in animals and thus pose a potential risk of cancer in humans. Naturally occurring compounds shown to be carcinogenic in animals have been found in small amounts in the average U.S. diet. There is no evidence thus far that any of these substances *individually* makes a major contribution to cancer risk in the United States.
- Most mutagens detected in foods have not been adequately tested for carcinogenic activity. Although mutagenic substances are generally suspected of having carcinogenic potential, it is not yet possible to assess their contribution to the incidence of cancer in the United States.
- Overall, there is a shortage of data on the complete range of nonnutritive substances in the diet and thus no reliable estimates can be made of the most significant exposures. Exposure to nonnutritive chemicals individually, in the minute quantities normally present in the average diet, is unlikely to make a major contribution to the overall cancer risk to humans in the United States. The risk from simultaneous exposure to many such compounds cannot be quantified on the basis of current evidence.

THE COMMITTEE'S DIETARY RECOMMENDATIONS

The dietary recommendations of the Committee on Diet and Health, given below, are directed to healthy, North American adults and children. Wherever evidence permits, the committee attempts to identify the special dietary needs of population subgroups at high risk for specific diseases or with different dietary requirements because of age, sex, or physiological status. The special dietary needs of the elderly are largely unknown.

As discussed in Chapter 28, the quantities proposed in the committee's recommendations are goals for intake by *individuals*. To achieve these goals, the mean intake by the *population* (the public health goal) would have to be higher or lower than the recommended intake for individuals, depending on the direction of the proposed dietary modification. For example, a recommendation that all *individuals* should reduce their fat intake to 30% or less of calories can be expected to lead to a population mean intake substantially *below* 30% of calories from fat. Similarly, a recommendation that individuals increase their carbohydrate intake to more than 55% of total calories can be expected to lead to a population mean intake clearly above 55% of calories from carbohydrates. Thus, the guidelines for individuals differ somewhat from the public health (population) goals, which need to be more stringent in order to achieve the goals for individuals.

The extent to which the public health goal for a nutrient differs from the goal for individuals in the population will depend on the distribution of intake for that nutrient in the population. In most cases, however, the variation in nutrient intakes in the population is not well known.

The recommendations in this report are the product of a systematic and extensive analysis of the literature by a multidisciplinary committee that considered the criteria and the process for arriving at recommendations and documented the extensive literature on which they are based. They are generally in agreement with the advice provided by other expert panels in the United States and abroad although in most cases they include more specific quantitative recommendations. These recommendations are appropriate for current patterns of dietary intake and disease morbidity and mortality in the United States and are

based on conclusions regarding the association of dietary factors with the entire spectrum of chronic diseases. They take into account competing risks for different diseases as well as nutrient interactions. These recommendations should be reexamined as new knowledge is acquired and as the patterns of morbidity and mortality change over the next decades.

The committee's recommendations are presented in a logical sequence that also reflects a general order of importance. For example, all dietary macrocomponents are addressed first. Among these, highest priority is given to reducing fat intake, because the scientific evidence concerning dietary fats and other lipids and human health is strongest and the likely impact on public health the greatest. Lower priority is given to recommendations on other dietary components, because they are derived from weaker evidence or because the public health impact is likely to be comparatively less. Where the evidence is strongest, the committee presents quantitative recommendations. It recognizes that setting specific quantitative goals is somewhat arbitrary and is based on informed judgment rather than on scientifically derivable formulas; however, quantification facilitates translation of goals into dietary patterns and food choices. Goals are needed to develop and evaluate programs aimed at achieving dietary changes and serve as the basis for regulatory actions such as those relating to food labeling and the validity of health claims for foods and nutrients.

The committee's recommendations derive from an assessment of the evidence on chronic diseases, but should be used in combination with the RDAs to achieve an optimal and highly desirable dietary pattern for the maintenance of good health. In the committee's judgment, these recommendations have the potential for a substantial reduction in the risk of diet-related chronic diseases in the general population.

- *Reduce total fat intake to 30% or less of calories. Reduce saturated fatty acid intake to less than 10% of calories, and the intake of cholesterol to less than 300 mg daily. The intake of fat and cholesterol can be reduced by substituting fish, poultry without skin, lean meats, and low- or nonfat dairy products for fatty meats and whole-milk dairy products; by choosing more vegetables, fruits, cereals, and legumes; and by limiting oils, fats, egg yolks, and fried and other fatty foods.*

A large and convincing body of evidence from studies in humans and laboratory animals shows that diets low in saturated fatty acids and cholesterol are associated with low risks and rates of atherosclerotic cardiovascular diseases. High-fat diets are also linked to a high incidence of some types of cancer and, probably, obesity. Thus, reducing total fat and saturated fatty acid intake is likely to lower the rates of these chronic diseases. Fat intake should be reduced by curtailing the major sources of dietary fats rather than by eliminating whole categories of foods. For example, by substituting fish, poultry without skin, lean meats, and low- or nonfat dairy products for high-fat foods, one can lower total fat and saturated fatty acid intake while ensuring an adequate intake of iron and calcium—two nutrients of special importance to women. Dietary fat can also be reduced by limiting intake of fried foods, baked goods containing high levels of fat, and spreads and dressings containing fats and oils.

Different types of fatty acids have different effects on health. Saturated fatty acids and dietary cholesterol tend to increase total and LDL serum cholesterol and, consequently, the risk of cardiovascular disease. The extent of this activity differs among saturated fatty acids; palmitic, myristic, and lauric acids have the greatest cholesterol-raising effect. The main dietary sources of these cholesterol-raising saturated fatty acids are dairy and meat products and some vegetable oils, such as coconut, palm, and palm-kernel oils. Dietary cholesterol is found mainly in egg yolks, certain shellfish, organ meats, and, to a lesser extent, in other meats and dairy products. Thus, the intake of these foods should be curtailed.

Monounsaturated fatty acids are found in a variety of foods but are especially abundant in olive oil and canola oil. Polyunsaturated fatty acids are of two types—omega-6 and omega-3; both are essential nutrients and cannot be synthesized endogenously. Omega-6 polyunsaturated fatty acids are common in several plant oils, including corn, safflower, soybean, and sunflower oils. Omega-3 polyunsaturated fatty acids are found in cold-water marine fish (such as salmon and mackerel) and in some plant oils (e.g., soybean and canola oils). Omega-6 polyunsaturated fatty acids and monounsaturated fatty acids (and carbohydrates) lower LDL cholesterol when substituted for saturated fatty acids. Omega-3 polyunsaturated fatty acids also lower LDL-cholesterol when substituted for saturated fatty acids, but they are more effective in lowering elevated serum triglyceride levels. Although consumption of fish one or more times a week has been associated with a reduced risk of coronary heart disease, the committee does not

recommend the use of concentrated fish oil supplements, because there is insufficient evidence that they are beneficial and the absence of long-term adverse effects has not been established.

The evidence linking high-fat diets to increased cancer risk is less persuasive than that associating saturated fatty acids and dietary cholesterol to coronary heart disease, but the weight of evidence indicates that high-fat diets are associated with a higher risk of several cancers, especially of the colon, prostate, and breast. Most evidence from studies in humans suggests that total fat or saturated fatty acids adversely affect cancer risk. No studies in humans have yet examined the benefits of changing to low-fat diets; however, such evidence exists from experiments in animals. The combined evidence from epidemiologic and laboratory studies suggests that reduction of total fat is likely to reduce the risk of these cancers.

Epidemiologic data on the possible association of low serum cholesterol levels with an increased incidence of and mortality from cancer in general or colon cancer in men in particular are inconsistent and do not suggest a causal association. Rather, they indicate that the lower serum cholesterol levels in some of these studies were in part the consequence of undetected cancers. The overall evidence indicates that dietary modification to lower serum total cholesterol and coronary heart disease risk is likely to reduce the risk of colon cancer without increasing the risk of other cancers.

Animal studies also suggest that high-fat diets may lead to obesity, possibly because dietary fat is converted to body fat more efficiently than are other sources of calories. Short-term clinical studies in humans indicate that a substantial reduction in fat intake may be accompanied by weight loss; however, reduced caloric intake was observed in some of these reports and although not specifically noted is likely to have occurred in others. This indicates that a substantial reduction in fat intake may result in overall caloric reduction, perhaps because of the caloric density of dietary fat. From a public health perspective, this phenomenon may be important, regardless of whether fat reduction per se results in weight loss or that weight loss results from an overall reduction in caloric intake.

In the committee's judgment, concerns that reduced fat intake may curtail intake of meats and dairy products and thus limit intakes of iron and calcium by women and children or that young children on reduced-fat diets might not obtain adequate calories to support optimal growth and development are not justified. Fat intake can be reduced to approximately 30% of calories without risk of nutrient deficiency, and this level of fat intake after infancy has not been associated with any detrimental effects. Furthermore, adequate caloric intake can readily be maintained in children on diets containing 30% of calories from fat.

Although the committee recommends that the total fat intake of individuals be 30% or less of calories, there is evidence that further reduction in fat intake may confer even greater health benefits. However, the recommended levels are more likely to be adopted by the public because they can be achieved without drastic changes in usual dietary patterns and without undue risk of nutrient deficiency. Furthermore, they permit gradual adaptation to lower-fat diets as more lower-fat foods become available on the market. The committee recommends that people who should not lose weight should compensate for the caloric loss resulting from decreased fat intake by consuming greater amounts of foods containing complex carbohydrates (e.g., vegetables, certain fruits, legumes, and whole-grain cereal products).

Although the committee recommends that saturated fatty acid intake be maintained at less than 10% of total calories by individuals, it is highly likely that further reduction, to 8 or 7% of calories or lower, would confer greater health benefits. Such further reductions can best be achieved by substituting additional complex carbohydrates and monounsaturated for saturated fatty acids in the diet. Larger reductions in cholesterol intakes—e.g., to 250 or 200 mg or even less/day—may also confer health benefits.

The committee recommends that the polyunsaturated fatty acid intake of individuals not exceed 10% of total calories and that polyunsaturated fatty acid intake in the population be maintained at current levels in the U.S. diet, i.e., an average of approximately 7% of total calories. (The requirement for omega-6 polyunsaturated fatty acids can be met by 1 to 2% of calories as linoleic acid.) Concern that an increase in polyunsaturated fatty acid intake may increase risk of certain cancers derives primarily from studies of animals on very-high-polyunsaturated fatty acid diets. Given the absence of human diets naturally very high in total polyunsaturated fatty acids and the lack of information about the long-term consequences of high polyunsaturated fatty acid intake (see Chapter 7), it seems prudent to recommend that polyunsaturated fatty acid intake not be increased above the current average in the U.S. population. However, since most of the polyunsaturated fatty acids in the

current U.S. diet are of the omega-6 rather than the omega-3 type, and since the committee's recommendation is directed mainly at omega-6 polyunsaturated fatty acids, any increase in total polyunsaturated fatty acid resulting from an increase in foods containing omega-3 polyunsaturated fatty acids (e.g., by eating more fish containing such fatty acids) is reasonable.

- *Every day eat five or more servings* of a combination of vegetables and fruits, especially green and yellow vegetables and citrus fruits. Also, increase intake of starches and other complex carbohydrates by eating six or more daily servings of a combination of breads, cereals, and legumes.*

The committee recommends that the intake of carbohydrates be increased to more than 55% of total calories by increasing primarily complex carbohydrates. Fats and carbohydrates are the two major sources of calories in the diet. National food consumption surveys indicate that the content of the average U.S. diet is high in fat and low in complex carbohydrates (e.g., starches, vegetables, legumes, breads, cereals, and certain fruits). Green and yellow vegetables; fruits, especially citrus fruits; legumes; and whole-grain cereals and breads, which constitute a small portion of the present U.S. diet, generally contain low levels of fat; thus, they are good substitutes for fatty foods and good sources of several vitamins, minerals, complex carbohydrates, and dietary fiber. The recommended number of servings is derived from experience in planning nutritionally balanced diets that would meet the committee's dietary recommendations. The amounts recommended would facilitate an increase in the total carbohydrate and complex carbohydrate content of the diet, make up for the caloric deficit due to fat reduction, and supply sufficient quantities of essential vitamins and minerals. The committee does not recommend increasing the intake of added sugars, because their consumption is strongly associated with dental caries, and, although they are a source of calories for those who may need additional calories, they provide no nutrients. Furthermore, foods high in added sugars (e.g., desserts and baked goods) are generally also high in fat.

Studies in various parts of the world indicate that people who habitually consume a diet high in plant foods have low risks of atherosclerotic cardiovascular diseases, probably largely because such diets are usually low in animal fat and cholesterol, both of which are established risk factors for atherosclerotic cardiovascular diseases. Some constituents of plant foods, e.g., soluble fiber and vegetable protein, may also contribute—to a lesser extent—to the lower risk of atherosclerotic cardiovascular diseases. The mechanism for the link between frequent consumption of vegetables and fruits, especially green and yellow vegetables and citrus fruits, and decreased susceptibility to cancers of the lung, stomach, and large intestine is not well understood because the responsible agents in these foods and the mechanisms for their protective effect have not been fully determined. However, there is strong evidence that a low intake of carotenoids, which are present in green and yellow vegetables, contributes to an increased risk of lung cancer. Fruits and vegetables also contain high levels of fiber, but there is no conclusive evidence that the dietary fiber itself, rather than other nutritive and nonnutritive components of these foods, exerts a protective effect against these cancers. The committee does not recommend the use of fiber supplements.

Vegetables and fruits are also good sources of potassium. A diet containing approximately 75 mEq of potassium (i.e., approximately 3.5 g of elemental potassium) daily may contribute to reduced risk of stroke, which is especially common among blacks and older people of all races. Potassium supplements are neither necessary nor recommended for the general population.

- *Maintain protein intake at moderate levels.*

Protein is an essential nutrient, and protein-containing foods are important sources of essential amino acids in the diet. However, because there are no known benefits and possibly some risks in consuming diets with a high animal protein content, the committee recommends that protein intake not be increased to compensate for the caloric loss that would result from the recommended reduction in fat intake. In general, average protein intake by adults in the United States considerably exceeds the RDA, which is 0.8 g/kg of desirable body weight for adults. The committee recommends maintaining total protein intake at levels lower than twice the RDA for all age groups (e.g., less than 1.6 g/kg body weight for adults).

Increased risks of certain cancers and coronary heart disease have been associated in some epidemiologic studies with diets high in meat and, as a

*An average serving is equal to a half cup for most fresh or cooked vegetables, fruits, dry or cooked cereals and legumes, one medium piece of fresh fruit, one slice of bread, or one roll or muffin.

consequence, in animal protein, and with high protein intake alone in laboratory studies. It is not known whether these adverse effects are due solely to the usually high total-fat, saturated fatty acid, and cholesterol content of diets that are rich in meat or animal protein, or to what extent protein per se or other factors also contribute. High protein intake may also lead to increased urinary calcium loss.

The committee is aware of concerns among some scientists that animal protein restriction might curtail the ability of some population subgroups with habitually lower protein intakes (e.g., women and the elderly) to meet the RDA for certain other essential nutrients such as iron. However, the recommendation to maintain intake below twice the RDA for all age groups would require no reduction of current average intakes in the United States. The committee does not recommend against eating meat; rather, it recommends consuming lean meat in smaller and fewer portions than is customary in the United States.

• *Balance food intake and physical activity to maintain appropriate body weight.*

Excess weight is associated with an increased risk of several chronic disorders, including noninsulin-dependent diabetes mellitus, hypertension, coronary heart disease, gallbladder disease, osteoarthritis, and endometrial cancer. The risks appear to decline following a sustained reduction in weight. Increased abdominal fat carries a higher risk for these disorders than do comparable fat deposits in the hips and thighs. New standards for healthy body composition take into account such differences in regional body fat distribution as well as weight-to-height ratios. Neither large fluctuations in body weight nor extreme restrictions in food intake are desirable.

In the U.S. population and other westernized societies, body weight and body mass index are increasing while the overall caloric intake of the population is decreasing. These trends as well as the association of moderate, regular physical activity with reduced risks of heart disease lead to the committee's recommendation that the U.S. population increase its physical activity level and that all healthy people maintain physical activity at a moderately active level, improve physical fitness, and moderate their food intake to maintain appropriate body weight. For adult men and women of normal weight, this will also allow the ingestion of adequate calories to meet all known nutrient needs. Overweight people should increase their physical activity and reduce their caloric intake, and people with a family history of obesity should avoid calorically dense foods and select low-fat foods.

• *The committee does not recommend alcohol consumption. For those who drink alcoholic beverages, the committee recommends limiting consumption to the equivalent of less than 1 ounce of pure alcohol in a single day. This is the equivalent of two cans of beer, two small glasses of wine, or two average cocktails. Pregnant women should avoid alcoholic beverages.*

Excessive alcohol drinking increases the risk of heart disease, high blood pressure, chronic liver disease, some forms of cancer, neurological diseases, nutritional deficiencies, and many other disorders. Even moderate drinking carries some risk in circumstances that require neuromotor coordination and judgment, e.g., driving vehicles, working around machinery, and piloting airplanes or boats. Consumption of even small amounts of alcohol can lead to dependence. Approximately 10% of those who consume alcoholic beverages in the United States are alcoholics. Pregnant women and women who are attempting to conceive should avoid alcoholic beverages because there is a risk of damage to the fetus and no safe level of alcohol intake during pregnancy has been established.

Although several studies show that moderate alcohol drinking is associated with a lower coronary heart disease risk, it would be unwise to recommend moderate drinking for those who do not drink because, in the committee's judgment, a causal association has not been established and because even moderate drinking poses certain other risks, including the risk of alcohol addiction.

• *Limit total daily intake of salt (sodium chloride) to 6 g or less. Limit the use of salt in cooking and avoid adding it to food at the table. Salty, highly processed salty, salt-preserved, and salt-pickled foods should be consumed sparingly.*

Studies in human populations in different parts of the world show that a diet containing more than 6 g of salt per day is associated with elevated blood pressure, and many Americans habitually exceed this level. It is probable that susceptibility to salt-induced hypertension (salt sensitivity) is genetically determined, but no reliable genetic marker has yet been identified. Thus, those who are most susceptible to developing salt-induced hypertension, and therefore likely to benefit most from this recommendation, cannot yet be identified. In salt-sensitive people, the recommended level of salt intake is unlikely to contribute to

blood pressure elevation and may even lead to blood pressure reductions. In the general population, the recommended level will have no detrimental effect. The committee is aware that a greater reduction in salt intake (i.e., to 4.5 g or less) would probably confer greater health benefits than its present recommendation, but chose 6 g as an initial goal that can be achieved more readily. This does not preclude a subsequent recommendation for further reduction.

The evidence linking salt intake per se to stomach cancer is less persuasive than that for salt and hypertension. There is consistent evidence, however, that frequent consumption of salt-preserved or salt-pickled foods increases the risk of stomach cancer. The specific causative agents in those foods have not been identified.

- *Maintain adequate calcium intake.*

Calcium is an essential nutrient; it is necessary for adequate growth and skeletal development. Certain segments of the population, especially women, because of their low caloric intake, and adolescents, because of their higher nutrient requirements, need to make careful food choices to obtain adequate calcium from the food supply. The committee recommends consumption of low- or nonfat dairy products and dark-green vegetables, which are rich sources of calcium and can assist in maintaining calcium intake at approximately RDA levels. Although low calcium intake is associated with a higher frequency of fractures and possibly with high blood pressure, the potential benefits of calcium intakes above the RDAs to prevent osteoporosis or hypertension are not well documented and do not justify the use of calcium supplements.

- *Avoid taking dietary supplements in excess of the RDA in any one day.*

A large percentage of the U.S. population consumes some vitamin or mineral supplement daily. The supplements are often self-prescribed and not based on known nutrient deficiencies. It is not known what, if any, benefits or risks accrue to individuals or the general population from taking small doses of supplements. Some population subgroups (e.g., those suffering from malabsorption syndromes) may require supplements, but they should take them only under professional supervision. A single daily dose of a multiple vitamin-mineral supplement containing 100% of the RDA is not known to be harmful or beneficial; however, vitamin–mineral supplements that exceed the RDA and other supplements (such as protein powders, single amino acids, fiber, and lecithin) not only have no known health benefits for the population but their use may be detrimental to health. The desirable way for the general public to obtain recommended levels of nutrients is by eating a variety of foods.

Thus, the committee supports the general scientific opinion and the opinions of several other expert panels that have recently commented specifically on supplement use. It emphasizes, however, that the long-term health effects (risks and benefits) of supplements have not been adequately studied.

- *Maintain an optimal intake of fluoride, particularly during the years of primary and secondary tooth formation and growth.*

There is convincing evidence that consumption of optimally fluoridated water (i.e., 0.7 to 1.2 ppm fluoride, depending on ambient temperature) significantly reduces the risk of dental caries in people of all ages, especially in children during the years of primary and secondary tooth formation and growth. There is no evidence that such fluoride concentrations have any adverse effects on health, including cancer risk. In the absence of optimally fluoridated water, the committee supports the use of dietary fluoride supplements in the amounts generally recommended by the American Dental Association, the American Academy of Pediatrics, and the American Academy of Pediatric Dentistry.

IMPLICATIONS OF RECOMMENDATIONS FOR FOOD CHOICES

What do the committee's recommendations imply with regard to selection of foods and food groups? To some extent, this issue is addressed under each recommendation. Therefore, only a synthesis is provided here. Principles of food selection will also be explained in more detail in the committee's forthcoming report to the general public.

In summary, the diet recommended by the committee should contain moderately low levels of fat, with special emphasis on restriction of saturated fatty acids and cholesterol; high levels of complex carbohydrates; only moderate levels of protein, especially animal protein; and only low levels of added sugars. Caloric intake and physical activity should be balanced to maintain appropriate body weight. The recommendation to maintain total fat intake at or below 30% of total caloric

intake and saturated fatty acid intake at less than 10%, combined with the recommendation to maintain protein intake only at moderate levels, means that for most North Americans it will be necessary to select leaner cuts of meat, trim off excess fat, remove skin from poultry, and consume fewer and smaller portions of meat and poultry. Fish and many shellfish are excellent sources of low-fat protein. By using plant products (e.g., cereals and legumes) instead of animal products as sources of protein, one can also reduce the amount of saturated fatty acids and cholesterol in the diet.

Dairy products are an important source of calcium and protein, but whole milk, whole-milk cheeses, yogurt, ice cream, and other milk products are also high in saturated fatty acids. Therefore, low-fat or skim milk products should be substituted. Furthermore, it is desirable to change from butter to margarine with a low saturated fatty acid content, to use less oils and fats in cooking and in salad dressings, and to avoid fried foods.

For most people, the recommended restriction of fat intake, coupled with the recommendation for moderation in protein intake, implies an increase in calories from carbohydrates. These calories should come from an increased intake of whole-grain cereals and breads rather than from foods or drinks containing added sugars. For example, bakery goods, such as pies, pastries, and cookies, although they provide complex carbohydrates also tend to contain high levels of total fat, saturated fatty acids, and added sugars, all of which need to be curtailed to meet the committee's recommendations.

In general, vegetables and fruits are unlikely to contribute substantially to caloric intake but are major sources of vitamins, minerals, and dietary fiber. The committee places special emphasis on increasing consumption of green and yellow vegetables as well as citrus fruits, particularly since their consumption in North America is relatively low. The committee's recommendations would lead to a substantial increase in consumption frequency and portion sizes, especially of vegetables, for the average person. Thorough washing of fresh vegetables (especially leafy ones) and fruits will minimize the consumption of pesticide residues in the diet.

The need for restriction of certain dietary components—such as egg yolks; salt; salty, smoked, and preserved foods; and alcoholic beverages—is clearly explained in the recommendations. Further considerations include methods of preparation, cooking, and processing, which can have important effects on the composition of foods. The committee emphasizes the need to read the labels on prepared, formulated, and other processed foods to identify their contribution of nutrients in general and of salt, fats and cholesterol, and sugars in particular. With regard to the risk of chronic diseases, maximum benefit can be attained and any unknown, potentially harmful effects of dietary constituents minimized by selecting a variety of foods from each food group, avoiding excessive caloric intake (especially excessive intake of any one item or food group), and engaging regularly in moderate physical exercise.

IMPACT ON PUBLIC HEALTH: BENEFITS AND RISKS OF DIETARY MODIFICATION

The committee used several approaches and lines of evidence to assess potential adverse consequences of its dietary recommendations for the general population (see Chapter 28). For example, it examined the degree of concordance in death rates and mortality trends between the two leading diet-related causes of death—i.e., coronary heart disease and cancer—to assess the degree to which common dietary risk and protective factors may be operating. It also analyzed the possible adverse consequences of reducing the intake of total fat, saturated fatty acids, and cholesterol, which would lead to a reduction in serum cholesterol levels and in the risk of atherosclerotic cardiovascular disease.

In some studies, low serum cholesterol is associated with increased colon cancer mortality. However, this finding is inconsistent and the data do not suggest that lowering serum cholesterol by dietary modification would increase the risk of any cancer. Furthermore, the committee considered the effect of reducing total serum cholesterol on increasing risk of hemorrhagic stroke in hypertensives; the possible adverse effects of increased intakes of polyunsaturated fatty acids, carbohydrates, vegetables, and carotene and of moderate intakes of alcohol (as opposed to total avoidance); the effect of potential increases in exposure to pesticides; and the potential for nutrient deficiencies or toxicity among population subgroups (see Chapter 28). It concluded that despite using the worst-case hypothetical scenarios, the benefits of dietary modification far outweigh the potential for adverse effects, which is minimal if any, as summarized below.

The lines of evidence examined in Chapter 28 indicate that risk factors and protective character-

istics for the major diet-related chronic diseases and causes of death are concordant. In general, dietary intervention to reduce the risk of one disease (e.g., coronary heart disease) is also likely to reduce the risk of other diseases (e.g., several cancers).

Central to the committee's deliberations was the extent to which the overall risk of chronic diseases in the general U.S. population might be reduced by dietary modification. Because the role of dietary factors in the etiology of chronic diseases differs by factor and disease (see Major Conclusions), the impact of dietary modification on the risk of different diseases is likely to vary considerably.

As discussed in Chapter 28, the committee used several approaches in developing quantitative estimates of the potential public health impact if its dietary recommendations were to be fully adopted by the public. It recognized at the outset that the accuracy of such estimates is determined by the strength, consistency, and congruence of the evidence from a variety of sources, especially from extensive, long-term observations and dietary interventions in human populations, which provide the most reliable estimates of association. The best of these data pertain to serum cholesterol levels and the risk of coronary heart disease; those on dietary factors as they relate to coronary heart disease, cancer, and other major causes of mortality are not as extensive.

Estimates for the reduction of coronary heart disease risk in human populations can be derived by extrapolating the effects of a downward shift in average serum cholesterol levels, by comparing coronary heart disease risk in populations with greatly different saturated fatty acid or total fat intakes or wide ranges in mean serum cholesterol levels, or by examining the results of serum-cholesterol-lowering trials on cardiovascular disease incidence. The many drawbacks to these approaches are explained in Chapter 28. In general, however, by using these approaches, the committee estimates that its recommendations for reducing intake of saturated fatty acids, dietary cholesterol, and total fat could lead to at least a 10% reduction in serum cholesterol levels and a 20% reduction in coronary heart disease risk in the United States beyond the 1987 levels. More stringent dietary modification provides the potential for even greater reduction in coronary disease risk in the future. This underestimates the potential benefits of dietary modification because it only focuses on certain lipids and does not take into account the potential benefits of reductions in body weight and blood pressure in the population.

The picture is less clear for the risk of cancer and other chronic diseases. Some epidemiologists estimate that as much as 90% of all cancer in humans can be attributed to various environmental factors, including diet. Others attribute 30 to 40% of cancers in men and 60% of cancers in women to diet. Still others have estimated that 10 to 70% of the deaths from cancer could be prevented by dietary modifications, especially for cancers of the stomach, the large bowel, and to a lesser extent, the breast, the endometrium, and the lung.

The conclusions of the Committee on Diet and Health are in general agreement with those of the National Research Council's Committee on Diet, Nutrition, and Cancer, which in 1982 concluded that cancers of most major sites are influenced by dietary patterns. The data are not sufficient, however, to quantify the contribution of diet to the overall cancer risk or to determine the quantitative reduction in risk that might be achieved by dietary modifications. The committee notes that several countries with dietary patterns similar to those recommended in this report have about half the U.S. rates for diet-associated cancers. This suggests that the committee's dietary recommendations could have a substantial impact on reducing the risk of cancer in the United States.

For the other chronic diseases and conditions considered in this report (i.e., hypertension, obesity, osteoporosis, diabetes mellitus, hepatobiliary disease, and to a lesser extent, dental caries), the magnitude of risk reduction expected through full implementation of the committee's guidelines on diet and health cannot be reliably estimated at this time due to limitations in the data. Nevertheless, on the basis of its overall assessment of the data, the committee concludes that implementation of its dietary recommendations through readily available natural diets is likely to greatly reduce the overall risk of these chronic diseases without discernibly increasing the risk of any cause of death or disability.

In Chapter 28, the committee categorizes dietary factors according to the strength of the evidence and relates each to the risk of chronic diseases and the potential public health benefit of dietary modification. In the committee's judgment, modification of the total diet along the lines recommended in this report is necessary to achieve the maximum public health benefit; and among dietary factors, reduced intakes of total fat, satu-

rated fatty acids, and cholesterol are likely to have the greatest impact.

IMPLEMENTATION OF DIETARY RECOMMENDATIONS

What strategies are needed to implement the committee's dietary recommendations and what are their implications for different sectors of society? These issues are the subject of a separate study by the Food and Nutrition Board. Therefore, they only receive brief consideration below and in Chapter 28 of this report.

It is apparent to the committee and the Food and Nutrition Board that if one of our national goals is to reduce the risk of chronic diseases and if dietary modification is likely to assist in achieving that goal, then various sectors of society need to collaborate in implementing dietary recommendations of the type proposed by the committee. The committee is aware that many nutrition programs and regulatory actions that are already in place or under way under the auspices of government agencies and in the private sector are consistent with implementing the proposed recommendations. Nevertheless, it wishes to draw special attention to the following general issues.

A concerted effort will be needed to make the changes in the food supply and in nutrition policy and programs that will be required to increase the availability of low-fat and low-salt foods in supermarkets and in public eating facilities such as school cafeterias and restaurants. Consideration needs to be given to the most effective means of achieving such modification: through technological changes, massive public education efforts, legislative measures such as food labeling, or a combination of such strategies. Although the committee's report to the public, which will be issued in the near future, will explain its major conclusions and recommendations in lay terms, leaders in government agencies, the health professions, the food industry, and the mass media face the challenge of interpreting the committee's nine recommendations for the general public as well as for high-risk groups. They will need to convey in practical terms the concept of certainty or uncertainty of benefit, competing risks, dietary interactions, and target populations. There is a need to develop adequate educational tools and to identify the best means of educating and motivating the public. Health professionals, government agencies, and the industry must also undertake additional research to identify ways of effecting dietary change.

In the committee's judgment, it is feasible to implement the proposed recommendations within the framework of the average lifestyle in the United States, and the committee is encouraged by the knowledge that dietary habits in this country have already changed markedly in many ways that are consistent with these recommendations. To convey a full understanding of these recommendations to the public and to implement them will require close collaboration among government agencies, the food industry, health professionals (physicians, nutritionists, dietitians, and public health personnel), educational institutions, leaders in mass media, and the general public.

RESEARCH DIRECTIONS

Fundamental scientific discoveries generally occur in completely unexpected ways. Thus it is impossible to predict where the major discoveries will be made or which research directions will prove to be the most fruitful. Therefore, the committee does not wish to stifle creativity by specifying experimental protocols or directing research. Nevertheless, it is possible and desirable to propose a scheme for organizing research to seek more definitive data on the associations between diet and chronic diseases. The committee's conclusions and dietary recommendations reflect its assessment of current knowledge and actions justified now; they can be made more definitive only through additional research of the kind recommended in this section.

The seven categories of research proposed below are not presented in order of priority. Rather, taken together, they reflect a conceptual framework for interdisciplinary collaborative research that encompasses different kinds of investigations: short- and long-term experiments in vitro and in vivo, food consumption surveys, food composition analyses, descriptive and analytical epidemiologic studies, metabolic studies and clinical trials in humans, and social and behavioral research. More detailed and specific research recommendations are summarized in Chapter 28 and presented in Chapters 4 and 6 through 26.

- *Identification of foods and dietary components that alter the risk of chronic diseases and elucidation of their mechanisms of action.*

Much needed research falls in this category. Many dietary constituents are already known to play a role in the etiology of chronic diseases, but additional and more specific knowledge, especially

concerning mechanisms of action, will lead to more definitive conclusions and provide more precise guidance about ways to reduce the risk of different chronic diseases.

• *Improvement of the methodology for collecting and assessing data on the exposure of humans to foods and dietary constituents that may alter the risk of chronic diseases.*

Methodological shortcomings inhibit the interpretation and analysis of data and often prevent the derivation of precise conclusions about the association of diet and chronic diseases. Thus, the committee recommends that high priority be given to development of better methods for data collection, quantification of dietary exposures and effects, and data analysis.

• *Identification of markers of exposure and early indicators of the risk of various chronic diseases.*

This category of research is designated for two purposes: first, to circumvent the shortcomings of using the disease itself as the sole end point—i.e., because of the long latency period of many chronic diseases evidenced by the delay between dietary exposure and disease expression; and second, to circumvent problems due to exposure misclassification when dietary recall methods are used. In the committee's judgment, there is a pressing need to identify biochemical/biological markers of dietary exposure, early biological markers that can forecast the emergence of clinical disease, and genetic markers that can identify high-risk subgroups in the population. In addition, the committee proposes greater use of the techniques of molecular biology to study gene–nutrient interactions that can help characterize individual variability in nutrient requirements and response to various chronic diseases.

• *Quantification of the adverse and beneficial effects of diet and determination of the optimal ranges of intake of dietary macro- and microconstituents that affect the risk of chronic diseases.*

Although most dietary constituents are known to have some effect on the risk of certain chronic diseases, much less is known about the magnitude of this effect. The committee believes that there is a strong need to quantify these effects in order to estimate the contribution of diet to the risk of chronic diseases. These efforts should include a study of nutrient interactions, competing risks, and dose-response relationships. The ultimate aim of such research should be to determine the optimal ranges of intake of various dietary components for health maintenance, keeping in mind the desirability of identifying their effects and the shape of the dose-response curve.

• *Through intervention studies, assessment of the potential for chronic disease risk reduction.*

Carefully designed intervention studies should be conducted to assess the public health impact of dietary modification. Although many such studies have been conducted for heart disease, hypertension, dental caries, and obesity, and a few have focused on osteoporosis, no such long-term studies have yet been completed for cancer. The committee has considered whether priority should be given to additional large-scale trials or whether current knowledge is sufficient to undertake dietary interventions in the population and subsequently to assess their effectiveness by carefully monitoring trends in disease incidence and mortality.

Intervention trials should be undertaken only when a substantial body of data indicates a high likelihood of benefit without discernible risk. Such trials might be warranted to obtain more definitive data, especially because the kinds of diets tested in such trials might yield data about potential benefits of dietary intervention to simultaneously reduce the risk of multiple chronic diseases, but they should not be used as a basis for delaying prudent dietary modifications warranted by current knowledge. Any intervention studies should be accompanied by effective monitoring to assess disease incidence, prevalence, and mortality rates.

• *Application of knowledge about diet and chronic diseases to public health programs.*

Social and behavioral research should be undertaken to achieve a better understanding of factors that motivate people to modify their food habits. This knowledge is indispensable for designing effective public health programs to reduce the risk of chronic diseases. Furthermore, improved technologies are needed to increase the availability of foods that conform to the committee's dietary recommendations.

• *Expansion of basic research in molecular and cellular nutrition.*

The six categories described above focus on research to enhance knowledge of the interrelationship among dietary factors, chronic diseases, and health, and this research includes an understanding of the underlying mechanisms. The committee wishes to emphasize the need for such

fundamental research to advance our knowledge of basic cellular and molecular mechanisms. Research in disciplines ranging from the physical sciences, to biochemistry, physiology, applied biology, nutrition, medicine, epidemiology, biophysics, cellular and molecular biology, and genetics is needed to fill the gaps in our understanding of how dietary, environmental, and genetic factors interact to influence the risk of chronic diseases.

The committee hopes that the findings contained in this report will be as widely disseminated as possible and urges that all those with an interest in and responsibility for public health participate in this effort. Recognizing the limitations of current knowledge, it strongly believes that periodic updates of its findings will be necessary as new data emerge to shed more light on associations between diet and chronic diseases.

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