



NINTH · EDITION

NUTRITION

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Preface

OUR KNOWLEDGE of the nutrients and the metabolic processes they undergo in the body to maintain health and promote growth continues to expand through the findings of research. However, there is a gap between the scientific knowledge of nutrition and its application. Malnutrition and undernutrition are still grave problems throughout the world, both in developing countries and in the developed countries, including the United States. Education in the application of nutrition knowledge is urgently needed, particularly in light of the rapidly expanding world population and the threat of food-population imbalance.

Today's student of nutrition has the responsibility of acquiring the most recent and accurate information on nutrition and of applying this knowledge in both personal living and the professional field. The ninth edition of *Nutrition* has been prepared for this purpose. It has been almost completely rewritten and extensively reorganized. New topics discussed include nutritional labeling, the need for a national nutrition policy, the proposed dietary goals for the United States, and the recommendations of the 1974 World Food Con-

ference. The literature was thoroughly reviewed during preparation of the revision. The most recent material available is used throughout. Many new figures and tables are included.

As in earlier editions, the text deals with the individual's health as related to food and the body's ability to use it. The emphasis is on normal nutrition, the interrelationships of nutrients, and the world food situation. Although discussion of nutrition during disease is not included in detail, certain pathological conditions in which diet is of primary importance are mentioned.

The material is presented in a simple, understandable manner for use in beginning and intermediate college courses. To serve its proper function as a text, the book sets an authoritative standard for good health and supports it by citing experimental evidence. The references at the end of each chapter are the investigations mentioned in the text, and those that involved human subjects were given preference. General references also are included for use by those who wish to make further exploration of a subject.

Books and journals that may be useful in

supplementing and expanding the information discussed in the text are listed in Appendix A. Appendix E gives nutritive values in common household measures for more than 700 foods, as revised in 1977 by the Agricultural Research Service, United States Department of Agriculture. A list of food composition tables for use in the United States and one for use in other parts of the world, and metric conversion information are included in the Appendixes C and D.

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Nutrition

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Contents

Preface x

1. Nutrition, Food, and Health 1

- Global Nutrition Problems 1
- Factors Affecting the Food Supply and the Quality of the Diet 7
- Approaches to the Study of Nutrition in Relation to Health 18
- Dietary Intake Standards 20
- Evaluation of Nutrition Status 22
- References 30
- General References 33

2. Food, the Source of Energy and Nutrients 35

- The Classification of Nutrients and the Functions of Food and Nutrients 35
- The Energy Value of Food 39
- Measuring the Energy Value of Food 40
- The Physiological Fuel Value of Food 41
- Tables of Food Composition 43
- References 43
- General References 44

3. The Energy Balance 47

- Methods for Ascertaining the Body's Energy Needs 47
- Basal Metabolism and Its Measurement 51
- Estimation of Basal Metabolic Needs 53
- Factors that Influence the Basal Metabolic Rate 56
- Factors that Affect the Total Energy Requirement 58
- Estimation of Total Energy Needs 61
- Recommended Energy Intakes 62
- Meeting the Body's Need for Fuel 64
- Regulation of Body Weight 66
- References 70
- General References 74

4. Carbohydrates 77

- Chemistry, Classification, and Sources 77
- Digestion, Absorption, and Metabolism 80
- Functions 83
- Carbohydrate in the Diet 84
- References 86
- General References 87

5. The Lipids 89

Chemistry and Sources 90
Digestion, Absorption, and
Metabolism 93
Functions 95
Consumption of Fat 96
Lipids and Heart Disease 98
References 100
General References 102

6. Protein 105

Chemistry and Classification 107
Digestion, Absorption, and
Metabolism 108
Functions of Proteins and Amino
Acids 110
Estimation of the Requirement for
Protein 112
Recommended Dietary Allowances 116
Evaluation of Protein and Amino
Acids 117
Protein Quality Standards 119
Factors Affecting Protein
Utilization 121
Meeting the Daily Allowance for
Protein 123
Increasing the Quality and Quantity of
Protein Available in the World 124
Deviations from the Accepted
Standards 130
References 133
General References 136

7. Calcium, Phosphorus, and Magnesium 139

CALCIUM 139

Distribution in the Body in Relation to
Functions 139

Absorption and Retention 142
Requirements and Recommended
Allowances 145

Dietary Sources 147
Calcium in Food in the United
States 149

PHOSPHORUS 151

Distribution in the Body in Relation to
Functions 151

Absorption and Retention 152
Requirements and Recommended
Allowances 152

Dietary Sources 154

MAGNESIUM 154

Distribution in the Body in Relation to
Functions 154

Absorption and Retention 156
Requirements and Recommended
Allowances 157

Dietary Sources 159

References 160

General References 164

8. Iron 167

Distribution in the Body in Relation to
Functions 167

Absorption and Retention 169

Dietary Factors Affecting Iron
Absorption and Utilization 171

Anemia and Iron 172

Requirements and Recommended
Allowances 174

Dietary Sources 175

Iron in Food in the United States 177

References 179

General References 182

9. Iodine 185

Distribution in the Body in Relation to
Functions 185

Absorption and Retention 188
Requirements and Recommended
Allowances 189

Dietary Sources 190

Iodine Nutritional Status 193

Effects of Lack of Iodine 194

References 196

General References 198

10. Other Mineral Elements 201

CHROMIUM 201

Distribution and Functions 201

Dietary Sources and Requirements 203

COPPER 203

Distribution and Functions 203

Dietary Sources and Requirements 206

ZINC 206

Distribution and Functions 206

Dietary Sources and Requirements 209

FLUORINE 209

Distribution and Functions 209

Dietary Sources and Requirements 212

MANGANESE 213

Distribution and Functions 213

Dietary Sources and Requirements 214

MOLYBDENUM 215

Distribution and Functions 215

Dietary Sources and Requirements 215

SELENIUM 216

Distribution and Functions 216

Dietary Sources and Requirements 217

SODIUM, CHLORINE, AND POTASSIUM 219

Distribution and Functions 219

Dietary Sources and Requirements 220

COBALT 221

Distribution and Functions 221

Dietary Sources and Requirements 221

SULFUR 222

Distribution and Requirements 222

Dietary Sources and Requirements 223

NICKEL, SILICON, TIN, AND

VANADIUM 223

References 223

General References 229

11. The Fat Soluble Vitamins 233

VITAMIN A 234

Chemistry of Vitamin A and Its

Precursors 234

Absorption, Storage, and Transport 237

Functions 239

Requirements and Recommended

Dietary Allowances 242

Dietary Sources 246

Vitamin A in Food in the United

States 249

VITAMIN D 250

Chemistry of Vitamin D and Its

Precursors 250

Absorption, Transport, Metabolism, and

Storage 253

Functions 254

Requirements and Recommended Dietary

Allowances 258

Sources 260

VITAMIN E 261

Chemistry 261

Absorption, Transport, and Storage 262

Functions 264

Requirements and Recommended Dietary

Allowances 266

Dietary Sources 268

VITAMIN K 270
 Chemistry 270
 Absorption, Transport, and
 Metabolism 271
 Function, Requirements, and
 Sources 271
 References 272
 General References 279

12. The Water Soluble Vitamins 283

VITAMIN C 283
 Chemistry 283
 Absorption, Storage, and Excretion 286
 Functions 287
 Requirements and Recommended Dietary
 Allowances 290
 Dietary Sources 291
 Vitamin C in Food in the United
 States 294
 THIAMIN 295
 Chemistry 295
 Absorption, Storage, and Excretion 297
 Functions 298
 Requirements and Recommended Dietary
 Allowances 300
 Dietary Sources 301
 Thiamin in Food in the United
 States 304
 RIBOFLAVIN 305
 Chemistry 305
 Absorption, Storage, and Excretion 307
 Functions 308
 Requirements and Recommended Dietary
 Allowances 309
 Dietary Sources 310
 Riboflavin in Food in the United
 States 312

NIACIN 313
 Chemistry 313
 Absorption, Storage, and Excretion 317
 Functions 317
 Requirements and Recommended Dietary
 Allowances 318
 Dietary Sources 319
 Niacin in Food in the United States 320
 VITAMIN B-6 322
 Chemistry 322
 Functions 323
 Requirements and Recommended Dietary
 Allowances 325
 Dietary Sources 327
 FOLACIN (FOLIC ACID) 330
 Chemistry 330
 Absorption, Storage, and Excretion 331
 Functions 331
 Requirements and Recommended Dietary
 Allowances 333
 Dietary Sources 333
 VITAMIN B-12 335
 Chemistry 335
 Absorption, Storage, and Excretion 337
 Functions 338
 Requirements and Recommended Dietary
 Allowances 339
 Dietary Sources 340
 PANTOTHENIC ACID 341
 Chemistry and Functions 341
 Requirements and Dietary Sources 343
 BIOTIN 344
 Chemistry and Functions 344
 Requirements and Dietary Sources 346
 OTHER NUTRIENT FACTORS 346
Para-Aminobenzoic Acid, Choline, and
 Inositol 346
 References 347
 General References 360

13. Water and Electrolyte Balance 363

WATER 364

Water Content of the Body 364

Functions 365

The Maintenance of Water Balance 365

Amount of Water Needed by the Body 367

ELECTROLYTE BALANCE 368

Sources of Acid and Base 368

Body Adjustment to Variations in Acid and Base 370

References 372

General References 372

14. Nutrition During the Reproductive Period 375

Nutritional Considerations During Pregnancy 375

Nutrition and Lactation 383

References 385

General References 386

15. Nutrition During Infancy 389

Nutrient Requirements of the Infant 389

Breast Feeding and Bottle Feeding 397

Practical Problems of Feeding 399

Additions During the First Year 401

Indications of Health in an Infant 407

References 409

General References 411

16. Nutrition During Childhood, Adolescence, and the Later Years 413

CHILDHOOD AND ADOLESCENCE 413

Energy Requirement 416

Protein and Mineral Requirements 417

Vitamin Requirements 419

Other Aspects of Child and Adolescent Nutrition 420

THE LATER YEARS 427

The Aging Process 427

Nutritional Requirements 428

Planning Meals for the Aging 431

References 435

General References 437

17. Nutrition Today 441

World Problems Related to Nutrition 441

Nutrition Problems in the United States 448

Other Nutritional Concerns of Today 453

References 459

General References 461

Appendix A	General References 464
Appendix B	Reference Abbreviations 465
Appendix C	List of Food Composition Tables 468
Appendix D	Metric Equivalents 472
Appendix E	Tabular Material 473
Appendix F	Chemical Formulas 527

Index 540

1 Nutrition, Food, and Health

NUTRITION IS the science of food as it relates to health. It includes all the processes by which the living organism ingests, digests, absorbs, and uses the nutrients in foods for maintenance, growth, and reproduction. The human being requires more than 45 different nutrients for these vital functions. Good nutrition, through supplying sufficient amounts of all the essential nutrients in one form or another, has been shown to promote buoyant good health, physical stamina, mental alertness, emotional stability, and even longevity.

In recent years, nutrition has emerged from the classroom into the public domain. Almost daily, the news media—press, radio, and television—bring nutrition information to their audiences. In this country, the nutrient content of the foods available in the marketplace has become of concern and interest to the general public as well as to legislators. Largely as a result of this consumer concern, nutrition labeling of foods has become a reality. Therefore, some knowledge of basic nutrition facts is essential if people are to be able to

understand, interpret, and use the nutrition information that is being disseminated.

GLOBAL NUTRITION PROBLEMS

Hunger and malnutrition Millions of people in the world are malnourished or undernourished, some even starving, due to lack of food, knowledge, and health care facilities. Many of these are infants and children under six years of age (1–3). It has been estimated that 50 percent of the children in developing countries in the Middle East, Africa, Asia, Latin America, and South America suffer from protein-calorie malnutrition (4, 5). In many developing countries, especially in Asia, hundreds of thousands of children are blind or threatened with blindness due to vitamin A deficiency (6) (Figure 1.1). Nutritional anemia and riboflavin deficiency, particularly among mothers and children, are problems in many parts of the world. Malnutrition due to lack of food not only results in deficiency diseases and retardation of physical growth and development but if it is severe,



FIGURE 1.1 Malnourished child nearly blind due to vitamin A deficiency. (Department of Health, Republic of The Philippines)

in mental retardation, abnormal behavior, and damage to nerve and brain tissue (7-10).

Many national and international organizations are working toward the alleviation and solution of the world problems of hunger and malnutrition. Several agencies of the United Nations have special interest in these problems. The Food Policy and Nutrition Division of the Food and Agriculture Organization (FAO) is concerned with nutrition problems related to the production, processing, storage, distribution, and consumption of food. The Nutrition Section of the World Health Organization (WHO) has as its primary responsibility the investigation of clinical nutrition problems. WHO works closely with FAO in combating the nutrition deficiencies that accompany diseases and infections. The United Nations Children's Fund (UNICEF), formerly known as the United Nations International Children's Emergency Fund, was established to improve the health and welfare of children. UNICEF provides food, medicine, vaccine, and equipment for services to mothers and children in developing countries. The United Nations Educational, Scientific and Cultural Organization (UNESCO), concerned primarily with reducing the high incidence of illiteracy in the world, contributes to improving world nutrition through their "Food for People" projects. Often these projects are undertaken in cooperation with FAO, WHO, or UNICEF. The Agency for International Development (AID) of the Department of State contributes to improving the nutrition of people in developing countries

through programs in education and agriculture (Figures 1.2 and 1.3).

Food and nutrition surveys Recent food consumption and nutrition surveys have uncovered evidence of poor dietary intakes and malnutrition in the United States. The findings from the fifth food consumption survey, conducted during four seasons from the spring of 1965 through the winter of 1966 by the Agricultural Research Service (ARS) of the United States Department of Agriculture (USDA), showed a decline in the quality of diets from what was found in the fourth survey, which was conducted in 1955 (11). Only 50 percent of diets were rated "good" in 1965-1966, compared with 60 percent in 1955. In addition, 21 percent were rated "poor" in 1965-1966, compared with 15 percent in 1955. Intakes of calcium and vitamins A and C were found to be low in both surveys, but they were lower in 1965-1966 than in 1955. Since the data collected in these surveys were on foods as they came into the kitchen, the findings represent foods purchased rather than physiological consumption and indicate changes in the quality of dietary intake, but not necessarily evidence of malnutrition per se.

The first comprehensive survey to assess nutritional status in the United States was initiated in 1967 by the Nutrition Program of the United States Public Health Service (USPHS), formerly the Interdepartmental Committee on Nutrition for National Defense (ICNND). Originally, it was to be a national nutrition survey. Because of constraints of time and money, however, it

was conducted in only 10 states, with a separate survey of New York City; therefore it is referred to as the Ten-State Nutrition Survey (12,13). Approximately 70,000 individuals of all age groups in low-income areas of Washington, California, Texas, Louisiana, South Carolina, Kentucky, West Virginia, Michigan, Massachusetts, and New York were included in the study. In order that all the findings would be comparable, each survey was conducted according to the procedures outlined in the ICNND *Manual for Nutrition Surveys* (14). The results indicated that a significant number of the population studied were malnourished or were at high risk

of developing nutritional problems. Generally, malnutrition was found to be most prevalent among blacks, less among Spanish-Americans, and least among whites. Anemia was common at all ages, and low blood levels of vitamin A were found frequently. A high prevalence of decayed teeth, missing teeth, and abnormal changes in gum tissue were observed. Adolescents between the ages of 10 and 16 had the highest unsatisfactory nutritional status, with males having more evidence of malnutrition than females. General undernutrition was apparent in all persons over 60. Since the Ten-State Survey was conducted on a sample that is not representative of the en-

FIGURE 1.2 Trainees in a wheat program in Mexico receive field instruction on ways of improving small farm production. (Agency for International Development)





FIGURE 1.3 Research on major cereal crops can benefit the ultimate consumer by providing better food and more of it. (Agency for International Development)