

FOOD, PEOPLE & NUTRITION

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AVI PUBLISHING COMPANY, INC.
Westport, Connecticut

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Westport, Connecticut

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Library of Congress Cataloging in Publication Data

Eckstein, Eleanor F
Food, people, and nutrition.

Includes bibliographies and index.

1. Nutrition. 2. Food. 3. Diet. I. Title.

TX354.E33

641.1

80-15575

ISBN 0-87055-355-0

Printed in the United States of America
by Eastern Graphics, Inc., Old Saybrook, Connecticut

Preface

The American mainstream diet is acknowledged to have its faults in relation to providing the nutrition everyone needs. Many foods that are not very nutritious individually are considered by nutrition experts to have considerable value. This seeming inconsistency is irrelevant. A nutritious diet is one that supplies the right assortment of nutrients in the right quantity at the right time in response to metabolic demands. Nutritive quality of the diet is independent of food source. An immense number of natural and/or formulated foods can be combined in providing a nourishing diet. But, knowledge of nutrient contributions of individual foods and an estimate of nutrient needs are both necessary prerequisites of informed decision-making.

An understanding of human nutrition involves knowledge of each of the nutrients and respective quantities necessary, the functions of each of the nutrients in metabolic processes, and the effects of variation in levels of supply and demand for each in the context of the food and people interactions that determine what and how much is eaten. Thus, a functional knowledge requires a blending of information from the various disciplines involved in foods and nutrition.

Most people do not have the opportunity to take three courses in nutrition, i.e., whole body nutrition, cellular level nutrition, and life cycle nutrition, plus three courses in foods, i.e., introductory food technology, meal management, and the cultural aspects of foods, in order to develop a functional understanding. Recognizing this fact, I was confronted with a need for a new approach in teaching nutrition. The concepts that make this textbook different were developed and tested in the classroom. This textbook is only a vehicle for sharing.

Most scientists are cautious, being aware of the limits of the extent of their knowledge. In writing scientific papers for an audience of scientists like themselves, the discussion of findings is often limited and inferences with respect to the implications and ramifications are left to the reader.

In the context of a scientific journal, such a procedure is all right. The intended reader should be knowledgeable enough to have demonstrated competence at the higher levels of learning, namely analysis and synthesis.

Unfortunately, in today's world this is no longer true. Many "scientific writers" routinely extract findings from context. Out of context, the points are picked up and used by the unscrupulous. Interesting, if not sensational, they form the basis for food and nutrient fads. This is an unwanted outcome. Therefore, I do not feel comfortable in leaving the tasks of analysis and synthesis to the reader. So, I have attempted to write this textbook in a style that deals with the problem of misinterpretation.

A number of style features have been used to alert the reader. Paragraph structure is deliberately designed to focus attention on the point. IF . . . THEN . . . logic is utilized for identification of accepted relationships. Qualifiers are used deliberately for specific delineation, e.g., "... from limited research using human subjects . . .," "... inferred from animal studies . . .," "Although some species differences have been observed, all species so far . . .," etc. All of these lead to a statement that starts with "The findings suggest . . ." Throughout, an attempt has been made to identify unknowns and points that are unknowable. Lists are used throughout for emphasis. The reader should note the deliberate and systematic use of the phrase, "... includes, but is not limited to . . ." It may imply that all factors may not be known or that a limited number of the more important items have been selected from an extensive array. I invite reader comment and suggestions for additions to content and corrections for clarity.

The universal true definition of a nutritious diet is unknown and unknowable. Under the controlled conditions of an experimental study, some limited information is obtained. From epidemiologic and other surveys, additional information is obtained. But, even taken together these kinds of information do not add up to the complete answer. They provide only an approximation that can be used as a working definition in making recommendations. Therefore, when a correction is recommended and implemented and results are assessed, some improvement will be demonstrated and so will unanticipated effects that require additional adjustments. These unanticipated effects are due to interactions that had been obscured previously by more pressing nutrient needs. Therefore, a new approximation, new recommendations, and new adjustments will be necessary on a continuing basis.

The disciplines of foods and nutrition are in a rapid growth phase, so data and concepts are updated frequently. The enduring portions form the basic content of this textbook. New evidence that creates another

view is indicated when presented. There are many gaps and these I have tried to identify.

One of my major interests is information processing. This involves (a) on-going monitoring of the technical literature in foods and nutrition, which includes but is not limited to research reports, conference proceedings, and government documents, (b) information retrieval, (c) classification, and (d) analysis, interpretation, and integration of new information into an evolving understanding of and philosophy with respect to contemporary events and issues related to the discipline. Understandings and appreciations that are generally accepted are acknowledged to come from the work of myriad unknown researchers. Other contributions are credited in the lists of references.

I gratefully acknowledge the assistance and cooperation of numerous book and journal editors in granting permission to quote. Credit lines provide specific information.

Government documents are in *the public domain*, so they cannot be copyrighted. Thus, permission to quote is unnecessary. I gratefully acknowledge frequent quotations from proceedings and reports of the Senate Select Committee on Nutrition and Human Needs. Hearings publications document the complete proceedings, including oral testimony of witnesses, questions by committee members, discussions among committee members that may include outside participation, written statements submitted for the record, other materials admitted as evidence during testimony, and correspondence and material submitted as a matter of record by committee members and staff. *Committee prints* are published internal reports of staff research, investigative and/or oversight hearings. As such, they may contain background historical and/or statistical information, situation reports, and legislative analyses. Committee reports are published reports to members of the Senate and House that summarize committee findings and make recommendations for legislative action. I am indebted to the USDA for tables and figures from some of these.

Further, I would like to express my appreciation to Dr. Norman W. Desrosier and Ms. Karen L. Carter of The AVI Publishing Company for their encouragement and assistance in bringing this book into being.

Errors of omission and commission are mine alone to bear. Your understanding is solicited.

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December 1979

Dedication

This book is dedicated to those individuals who desire to assume personal responsibility for monitoring and controlling their nutrient intake via adjustments in food and people interactions.

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Food Consumption and Life Expectancy

Food consumption patterns of Americans have changed greatly during this century, especially since World War II. The effects of these changes on health and various aspects of life-style are unclear. A growing public awareness that major changes have occurred and lack of explanation of expected effects or reassurance have undermined public confidence. So, many questions are being asked, e.g., What is the relationship between food consumption patterns and life expectancy?

The relationship between food consumption and life expectancy appears to be as follows:

(a) IF one rules out accidents as a cause of death, THEN life expectancy, or the probability of living X years, depends on physical health and well-being.

(b) IF one rules out malfunction and injury, THEN physical health depends on nutritional status, other conditions such as exercise being equal.

(c) Nutritional status is a result of the cumulative and aggregate intake of nutrients; it usually depends on food consumption.

The effects of extreme malnutrition of two types, i.e., deficiency or under-nutrition and excess or over-nutrition, on life expectancy have long been recognized. But, many cases coexist in all segments of the American population—a recently recognized finding.

Nutritionists can state only approximations of truth based on limited current knowledge, since all of the implications and ramifications are unknowable. This much is clear: (a) optimal nutritional status is a prerequisite to good health and (b) individual adults must take personal responsibility for control of their own nutrient intake and to monitor and adjust food consumption to changing physical needs.

The evidence accumulated to date demonstrates that food consumption by many Americans is not adjusted to supply nutrients for optimal nutritional status, given physiological needs. So, malnutrition has been implicated in the etiology of six out of ten leading causes of death in the

United States. For some of these conditions, the nature of the food consumption problem is known. The extent of the problem is unknowable; it is only approximated by population statistics and summarized as a mean, based on data collected at a certain point in time. However, the indications are that most of the health problems underlying the leading causes of death could be modified by adjustment of food consumption. Potential benefits from improved diets cannot be quantified. But, available evidence suggests that risk of developing a clinical condition can be reduced. The nature of the food consumption problems and what is known of the resulting effects on nutritional status and life expectancy will be summarized.

THE AMERICAN SITUATION

As of 1975, probably the best estimate of American health was contained in the "Report of the President's Biomedical Research Panel." This report stated:

... the state of general physical health in this country is considerably better than at any earlier period in history. There are ... serious problems for concern: perinatal mortality in impoverished sectors of the population is unacceptably high; the morbidity and mortality rates for cardiopulmonary disease, stroke, and cancer are slowly but steadily increasing; and chronic illness, especially in the aged, is a formidable problem. Nonetheless, the total mortality for the United States population in 1974 was less than 1 percent ... and the average life expectancy had risen to 72 years, the longest in the country's history.¹

As of July, 1977, another approximation became available. It showed a somewhat different picture. Life expectancy had increased to 81 years for females and 72 years for males, according to a report released by the Census Bureau. The increased life expectancy was attributed to reduction in death rate from major cardiovascular disease, especially myocardial infarctions. Information on whether the decrease in mortality rate was due to improved medical techniques or low cholesterol diets was not available.

An earlier 1977 report, "Dietary Goals for the United States," prepared by the staff of the Select Committee on Nutrition and Human Needs—the so-called "McGovern Committee"—contained some interesting statements:

¹From Anon. (1975).

The over-consumption of fat, generally, and saturated fat in particular, as well as cholesterol, sugar, and salt, and alcohol have been related to six of the ten leading causes of death: heart disease, cancer, cerebrovascular disease, diabetes, atherosclerosis and cirrhosis of the liver . . .

The over-consumption of food in general has become a major public health problem . . .

At the same time, current dietary trends may also be leading to malnutrition through under-nourishment. Fats and sugar are relatively low in vitamins and minerals. Consequently, diets reduced to control weight and/or save money, but which are high in fat and sugar, are likely to lead to vitamin and mineral deficiencies . . . low-income people may be particularly susceptible to inducements to consume high-fat/high-sugar diets. . .

During this century, the composition of the average diet in the United States has changed radically. Complex carbohydrates—fruit, vegetables and grain products—which were the mainstay of the diet, now play a minority role. At the same time, fat and sugar consumption have risen to a point where these two dietary elements alone now comprise at least 60 percent of total calorie intake, up from 50 percent in the early 1900's . . .

The diet of the American people has become increasingly rich—rich in meat, other sources of saturated fat and cholesterol, and in sugar. . . It has been pointed out repeatedly that total sugar use has remained relatively constant for a number of years. We would emphasize, however, that our total food consumption has fallen even though we still eat too much relative to our needs. Thus, the proportion of the total diet contributed by fatty and cholesterol-rich foods and by refined foods has risen. We might be better able to tolerate this diet if we were much more active physically, but we are a sedentary people.¹

Until recently, medical efforts largely were directed to treating the major diseases after they became clinically manifest. But, to undo the effects is difficult if not impossible. So, emphasis has shifted to detection of a developing pattern of risk and intervention with preventive measures, especially in relation to the following diseases: coronary heart disease, hypertension, cancer of breast and colon, obesity, diabetes, and cirrhosis of the liver. Each will be discussed briefly.

Coronary Heart Disease (CHD)

Excessive intakes of the following have been implicated as etiologic factors in the development of CHD: total fat, saturated fat, cholesterol, salt, sugar, and alcohol. Intakes of fat, saturated fat, and cholesterol have been correlated positively with serum cholesterol levels and so with

¹From Select Comm. on Nutrition and Human Needs, U.S. Senate (1977).

incidence of myocardial infarctions. Salt intake is related to blood pressure and hypertension, which aggravate a heart condition. Sugar and alcohol are low nutrient density foods that may displace foods containing needed minerals and vitamins, and have some not-clearly-defined effects of their own. In regard to CHD, the "Report of the President's Bio-medical Research Panel" stated,

There are no proven ways to prevent atherosclerosis. In a few cases of congenital hyperlipidemia the course of the disease can be improved by dietary and other measures to reduce blood cholesterol and lipid, but these are the exception. The ordinary, common type of atherosclerosis—probably the most common life-threatening disorder in our society—is still without a satisfactory explanation for the arterial lesions . . . Elaborate studies are planned or underway to learn whether a reduction in animal fat, or drugs to reduce cholesterol, will reduce the incidence or severity of atherosclerosis . . . Even so, if diet regulation proves to be partially effective, there will still be the crucial question whether the population at risk is willing to undergo radical changes in lifelong habits of eating.¹

Because dietary factors are clearly implicated, the Inter-Society Commission for Heart Disease Resources and the American Heart Association have issued recommendations. The Prudent Diet, which incorporates the recommended preventive diet modifications, is detailed in Chapter 24.

Hypertension

About one-third of the American population is susceptible to high blood pressure or hypertension when sodium intake is elevated. Table salt is the main source of sodium. Consumption ranges from 6 to 18 g, but only about 1 g is necessary to supply sodium.

Cancer of Breast and Colon

Dietary intake of fat has been correlated with incidence of breast and colon cancer. Incidence of colon cancer also has been correlated with low bulk diets. Speculation is that a high fat intake causes increased secretion of prolactin which induces breast tumors. Some evidence indicating that normal colon bacteria can produce carcinogens, perhaps from fat fragments, has been presented. Current speculation is that IF one consumes a low bulk diet and thus becomes constipated, so that the passage rate is

¹From Anon. (1975).

slower than normal, THEN carcinogens could be formed and absorbed. A return to a normo-bulk diet is advocated.

Obesity

A 1976 review, "Report of the President's Biomedical Research Panel," states the magnitude of the problem: "According to current estimates one-fourth to one-third of the American adult population and at least ten percent of American children are overweight or obese." A variety of health problems are created by or aggravated by obesity. So major efforts have been made to understand its etiology and to develop effective strategies for weight control.

Recent research has provided a basis for understanding and controlling obesity. According to the same report,

Both the number and size of fat cells (adipocytes) determine the fat content of the body. While the size of fat cells appears to be variable throughout life, the number of these cells apparently is not . . . the number of adipocytes in the organism stabilizes relatively early, certainly before adulthood, and remains a fixed quantity thereafter. Thus, it is suggested that the eventual weight pattern is set by early nutritional history, in infancy or during adolescence. Later in life, only cell size can be modulated.¹

Both fat and sugar are concentrated sources of energy and little else. Since they are preferred, they displace fruits, vegetables, and cereals in the diet. The latter are relatively low in calories and high in bulk; increased intake of these would ease the problem of weight control. Weight control is an important factor in increasing life expectancy of many people. Major changes in food consumption are necessary. See Chapter 24.

Diabetes

Testimony given at the 1973-1974 hearings of the "McGovern Committee" on diabetes and the daily diet supported the position that there is a definite connection. Some points made in the hearings were:

(a) Over-nutrition leads to diabetes in those predisposed to it because more insulin is necessary than can be produced. When insulin is insufficient to control blood sugar levels within normal ranges, the person is considered to be diabetic. Thus, overeating precipitates diabetes. This

¹From Anon. (1975).

occurs in about 85% of the more than 5 million cases of diabetes that exist.

(b) Diabetics are more vulnerable to cardiovascular disease since increased blood sugar leads to increased blood lipid levels. The result is progressive deposition of lipids in vascular tissue until occlusion occurs somewhere. If it occurs in the large blood vessels that supply the heart, heart tissue dies (myocardial infarction), which may disrupt or prevent heart muscle action and result in death.

(c) Diabetics are vulnerable to gangrene, especially of the toes. When the blood vessels become occluded, circulation is reduced. IF the tissue becomes infected, THEN the tissue dies.

(d) Diabetes is the leading cause of blindness—increased pressure in small blood vessels results in ruptures, formation of scar tissue, and blindness when light cannot penetrate the tissue.

(e) Diabetes also leads to kidney failure. Juvenile type diabetics develop kidney failure after 20 to 25 years of the disease due to a combination of the stress of filtering out the excess sugar and development of scar tissue resulting from occlusion and/or rupture of small blood vessels.

Management of diabetes usually involves a modified diet. The American Diabetes Association issued new guidelines for diet management in 1972. Important concepts for mild and moderately severe cases are:

(a) The most important objective is to attain and maintain "ideal" weight.

(b) Decrease fat intake to approximately 35% kcal.

(c) Increase carbohydrate intake to approximately 45% of kcal; consume these primarily as complex carbohydrates from starch, since it is broken down to glucose slowly and will not produce high blood sugar peaks.

(d) Food intake should be spaced in relation to exercise (and insulin activity peaks, if applicable) in order to avoid intermittent periods of low blood sugar.

IF dietary measures were followed, THEN the dependence on insulin and/or oral drugs might be reduced. Many cases can be controlled by diet alone.

Cirrhosis of the Liver

Immoderate consumption of alcohol is the major cause of cirrhosis. There is limited but conflicting evidence concerning the role of diet in its etiology. One study reported that the typically deficient teenage diet fed to rats seemed to predispose them to alcoholism. There is abundant evidence that alcoholics do not regularly consume a nutritionally adequate diet. And, there is some evidence that metabolism of alcohol by liver cells inflates the need for thiamin and a few other vitamins.

U.S. DIETARY GOALS

Malnutrition resulting from inappropriate food consumption is related to six of the leading causes of death, and modified intake is regarded as the solution to some major health problems. Therefore, as a result of the testimony heard by the "McGovern Committee," a set of dietary goals was developed. After additional testimony, a second set was developed (Select Comm. on Nutrition and Human Needs, U.S. Senate 1977). These are:

(a) To avoid overweight, and to consume only as much energy (calories) as is expended; if overweight, decrease energy intake and increase energy expenditure.

(b) Increase the consumption of complex carbohydrates and "naturally occurring" sugars from about 28% of energy intake to about 48% of energy intake.

(c) Reduce the consumption of refined and processed sugars by about 45% to account for about 10% of total energy intake.

(d) Reduce overall fat consumption from approximately 40% to about 30% of energy intake.

(e) Reduce saturated fat consumption to account for about 10% of total energy intake; balance with polyunsaturated and mono-unsaturated fats, which should account for about 10% of energy intake each.

(f) Reduce cholesterol consumption to about 300 mg per day.

(g) Limit the intake of sodium by reducing the intake of salt to about 5 g per day.

Attaining these dietary goals will require major changes in food consumption habits and practices on the part of a significant number of Americans. The ecological effects cannot be predicted because of the magnitude of the changes required and uncertainty regarding the degree to which changes can or will be made. The definitions of food/poison, the eating experience, and food and people interactions will all be affected. New strategies will need to be devised to help people make appropriate adjustments.

Simplified food group systems do not seem feasible because of the number of nutrients and foods involved as well as the need for individualization. A monitoring/feedback control system may work for those who come to value consumption of a nutritious diet that is designed to meet personal needs. Such a system is described in Chapter 19.

In 1948 Ms. Stiebeling, then chief of the Bureau of Human Nutrition and Home Economics in the USDA, made a statement that still holds:

We do not yet understand the dynamics of modifying food habits well enough to apply . . . laws (of nutrition) in a fully effective way. But we are all aware of the bewilderment that household food buyers feel over much of the current advertis-

ing—advertising that attempts to push to the maximum of human capacity the consumption of every separate commodity—indiscriminately. Surely in the education of the public and in the orientation of food production and trade for bettering consumption patterns, we should look at the physiological research, and at the relative economy and usefulness of various foods to serve these needs. And science should speak with one voice in broad over-all terms about food choice and food use. This will have to be done if we are to progress at a pace in keeping with scientific knowledge and potentialities.¹

In 1979, “Healthy People, The Surgeon General’s Report on Health Promotion and Disease Prevention” was published. It listed the six major causes of death for persons aged 25 to 64 years as heart disease, cancer, stroke, cirrhosis of the liver, all other accidents, and motor vehicle accidents (USNCHS 1976). Heart disease, cancer, stroke, influenza and pneumonia, arteriosclerosis, and diabetes mellitus were listed as the six major causes of death for adults aged 65 and older (USNCHS 1976). This report discussed the need for nutrition as part of a preventive health program and stated that Americans probably would be healthier if they consumed a diet low in calories, lower in saturated fat, cholesterol, salt, and sugar, with more complex CHO, and relatively more fish, poultry, and legumes, and less red meat.

In early 1980, “Nutrition and Your Health” was issued jointly by the USDA and the Department of Health, Education and Welfare. It was a set of general guidelines that are similar to the dietary goals in principle: eat a variety of foods; maintain ideal weight; avoid too much fat, saturated fat, cholesterol, sugar, and sodium; eat foods with adequate starch and fiber; if you drink alcohol, do so in moderation. The notation that, “These represent a nutritional consensus by scientists in the government’s food and health agencies,” adds the weight of authority in efforts of persuasion.

THE FOOD AND NUTRITION “TRIP”

Food and nutrition education programs are costly and are always at issue, provoking strong feelings on both sides. The real problem in relation to funding is that, “We can’t afford to and we can’t afford not to.” We cannot afford to fund the programs enough to aid everybody, updating and upgrading information and skills to keep pace with our growing understanding of nutrition and its many impacts. So, persons with an accounting mentality can always create a crisis in confidence regarding

¹From Select Comm. on Nutrition and Human Needs, U.S. Senate (1977).