

**HOW SHOULD THE
RECOMMENDED DIETARY
ALLOWANCES
BE REVISED?**

Food and Nutrition Board

Institute of Medicine

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The serpent has been a symbol of long life, healing, and knowledge among almost all cultures and religions since the beginning of recorded history. The image adopted as a logotype by the Institute of Medicine is based on a relief carving from ancient Greece, now held by the Staatliches Museum in Berlin.

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Preface

Should the Recommended Dietary Allowances (RDAs) Be Revised? The Food and Nutrition Board (FNB) members discussed the RDAs with this question in mind at its summer 1992 meeting. Because members disagreed with each other about the status of the scientific data base underlying the RDAs, the need to revise the report, and whether the traditional RDA concept encompassed current knowledge about nutrition and health promotion throughout life, the FNB concluded that discussion with the nutrition communities should be undertaken. Recent symposia and publications already had begun to chart the disparity in scientific opinion about revising the RDAs (see for example: Levine et al., 1991; Sauberlich and Machlin, 1992; Williams et al., 1992; Lachance et al., 1993; Hegsted, 1993; Steinbaugh et al., 1993). With this background in mind, FNB members agreed to broaden the involvement of the nutrition communities as active partners in developing the next (eleventh) edition of the RDAs.

After further discussion and polling colleagues, the FNB organized a symposium entitled *Should the Recommended Dietary Allowances Be Revised?*, which was followed by a public hearing. The purpose of the symposium and public hearing was to provide an open forum to discuss the uses and possible future directions for the RDAs. Both events were held June 28–29, 1993, at the National Academy of Sciences in Washington, D.C. For the symposium, the FNB invited speakers from government agencies that rely on RDAs in their various programs, nutrition scientists from academia and industry, nutrition and dietetic practitioners, and industry and foundation representatives. After one and one-half days of invited presentations, the FNB devoted an afternoon to hearing oral statements from interested individuals. The proceedings were

recorded, and written copies of statements presented at the hearing were submitted for the record. Lists of the speakers and those presenting oral and written testimony are included in Appendix A. A summary of the presentations and oral and written testimony is provided in Appendix B. The symposium was supported by internal funds from the National Academy of Sciences and by program development funds granted to the Academy by the Kellogg Endowment Fund.

Prior to the symposium, the FNB members and staff developed five questions that formed the framework for the presentations and testimony. These questions were intended to stimulate discussion and commentary about the issues needed to move the RDA process forward. These questions, which are listed below, were included in flyers advertising the symposium.

- What has been the experience in applying the RDAs in various settings, and what factors limit their use?
- What new evidence has arisen since publication of the 10th edition of the RDAs that would argue for a change from the present values or a re-examination of the evidence?
 - Should concepts of chronic disease prevention be included in the development of allowances? For which nutrients and other food components?
 - How should recommended levels of intake be expressed? Should single numbers be given for different age and sex categories, or should ranges of recommended intake be provided? How should the ranges be defined? Should toxic levels be included where data are sufficient to establish an upper acceptable limit?
 - Is knowledge of relationships among nutrients sufficient to consider when establishing RDAs?

The FNB was delighted with the quality of the presentations and the thoughtful nature of the comments. Despite the variety of views expressed, the speakers and testifiers unanimously agreed that the time has come to revise the RDAs.

To continue its collaboration with the larger nutrition community on the future of the RDAs, the FNB decided not to form an RDA committee at this time. Instead, it has prepared this concept paper summarizing the symposium, public hearing, and FNB discussions. In addition, this paper proposes an initial approach for revising the RDAs. There are three chapters: Chapter 1 presents a basic introduction to the RDAs. Chapter 2 includes a history of the RDAs and the conceptual changes that have taken place since the first edition in 1941. Chapter 3 outlines a new approach to the RDAs developed by the FNB. The FNB plans to disseminate this paper widely. To assist with the dissemination, the FNB has planned several symposia at nutrition-focused professional meetings (see Appendix C). Later this year, the FNB will review the comments

received in response to this concept paper and will continue the process of revising the RDAs through activities that will involve the nutrition community.

FOOD AND NUTRITION BOARD

The Food and Nutrition Board (FNB) was established in 1940 to address issues of critical importance pertaining to the safety and adequacy of the nation's food supply, to establish principles and guidelines for adequate nutrition, and to render authoritative judgment on the relationships among food intake, nutrition, and health. The FNB is a distinguished, multidisciplinary group comprising scientists and leaders with expertise in various areas of nutrition, nutritional biochemistry, food science and technology, epidemiology, food toxicology, food safety, public health, and food and nutrition policy. Since its inception, the FNB has examined the science and made recommendations to improve food quality and safety, thereby promoting public health and preventing diet-related diseases. The emphasis of the FNB's activities has, over the past few years, shifted from nutritional deficiencies to excesses or imbalances in food components. The FNB additionally has become increasingly concerned with the translation of available scientific knowledge of food composition and human nutrition to the improvement of public health.

Organizationally, the FNB is a unit of the Institute of Medicine, part of the National Academy of Sciences. The Academy is a private, nonprofit corporation established by federal charter, which was created by an Act of Congress and signed in 1863 by President Abraham Lincoln. The Institute, a national organization chartered under the Academy in 1970, acts as an adviser to the federal government and, upon its own initiative, identifies issues of medical care, research, and education. The Institute secures the services of eminent members of appropriate professions to examine policy matters pertaining to the public's health.

While the 10th edition of the RDAs was in production, the administrative responsibility for the FNB in 1988 was transferred from the National Research Council, the chief operating arm of the National Academy of Sciences, to the Institute of Medicine (IOM). The IOM was then in the process of revamping its program to give greater priority to opportunities in disease prevention and the enhancement of preventive medicine in medical education and practice. Since 1988, the Institute has achieved an effective integration of FNB activities in its operations.

Janet C. King, Chair
Food and Nutrition Board

Acknowledgments

Many individuals played important roles in the initiation of the process to revise the RDAs. Special thanks go to the RDA subcommittee of the FNB (Drs. Allen, DeLuca, Dwyer, Erdman, Hambidge, and Miller), who met with me in California in September 1993 to summarize the symposium findings and to begin drafting this paper. Dr. M.R.C. Greenwood, former FNB chair, and Dr. Edwin Bierman, vice-chair, were instrumental in initiating and leading this effort. FNB staff members Drs. Bernadette Marriott and Paul Thomas and administrative assistant Marcia Lewis worked many hours under short deadlines to assist with drafting and rewriting background papers and this paper. Another important contributor to this effort was Lieutenant Colonel Margaret P. Applewhite, a Senior Service College Fellow who joined the FNB in 1993. She helped develop background papers before the symposium and summarized the diverse commentary from the symposium for this report.

In particular I want to acknowledge the many contributions of Dr. Catherine E. Woteki, the former FNB director. It was Dr. Woteki who reactivated and summarized the many discussions and concerns of this and previous Boards and obtained the funds to support the symposium.

It is an interesting and stimulating time to be chair of the FNB. I urge you to read this paper and help us, through your comments and suggestions, to develop a final plan to revise the RDAs.

Janet C. King, Chair
Food and Nutrition Board

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Introduction

The science of human nutrition stands at a pivotal point in its development. We now understand not only that nutrients are essential for growth and development and health maintenance, but also that some play a role in the reduction of risk of chronic disease. We have also come to understand that some nutrients function as hormones and others as gene regulators. A time may come when recommendations about what constitutes a health-promoting diet could be tailored to an individual's genetic predisposition to disease. However, until we have more complete knowledge of genetic variability in nutrient needs for health promotion and disease prevention, we must continue to rely on population-based approaches. One such approach is to develop recommendations for nutrient intakes that are designed to cover individual variations in requirements and that also provide a margin of safety above minimal requirements to prevent deficiency diseases. This is the approach traditionally taken in establishing Recommended Dietary Allowances (RDAs).

Since the RDAs were first published in 1941, their application has expanded markedly. They serve important functions in a variety of nutrition-related activities that professionals in government, industry, academia, and the health services have undertaken. The many uses of the RDAs are summarized in Table 1. For example, the allowances are meant to serve as guides for procuring food supplies for groups of healthy persons, as the basis for planning meals for groups, as a reference point for evaluating the dietary intake of population subgroups, and as a component of food and nutrition education programs. Since 1972, the RDAs have functioned as the reference point for the nutritional labeling of foods and dietary supplements.

TABLE 1. Uses of the RDAs

USE	EXAMPLES	COMMENTS ON THE USE OF RDAs
Food planning and procurement	Use to develop plans for feeding groups of healthy people	Use as an appropriate nutrient standard for a period of at least a week, but also use as one of many food planning criteria; should be adjusted as group varies from RDA reference individual
	Use for food purchasing, cost control, and budgeting	Use as an appropriate nutrient standard with knowledge of such factors as food composition, availability, acceptability, and storage changes and losses
Food programs	Serve as a basis for the nutritional goal for feeding programs	Use as a standard for nutritional quality of meals along with other food selection criteria
	Provide the nutritional standard for the Thrifty Food Plan, the basis for allotments in the Food Stamp Program	Use as a guideline along with other food selection criteria
	Provide nutritional guidelines for food distribution programs	Use as a standard for nutritional quality of food packages
Evaluating dietary survey data	Evaluate dietary intake of individuals	Use as a standard for evaluating dietary status, but not for evaluating individual nutritional status
	Evaluate household food use	Use as a benchmark to compare households and to identify nutrient shortfalls
	Evaluate national food supply (food disappearance data)	Use only as a benchmark for comparison over time and to identify nutrient shortfalls
Guides for food selection	Develop and evaluate food guides and family food plans	Use along with other food selection criteria
Food and nutrition information and education	Provide guidelines for obtaining nutritious diets	Use as a point of reference; becomes more useful to consumers when translated into food selection goals

	Use as a basis for educators to discuss individuals' nutrient needs	Use in combination with information in the text accompanying the RDA table and with recognition that the RDAs are for reference individuals
	Evaluate an individual's diet as a basis for recommending specific changes in food patterns and/or dietary supplements	Use to identify nutrient shortfalls and as a tool to assess nutrient contribution of diet; do not use in prescriptive manner
Food labeling	Provide basis for nutritional labeling of foods	Use as a basis for labeling standards (U.S. RDA); such standards should not be used to determine nutritional intake of individuals or groups
Food fortification	Serve as a guide for fortification for general population	Use as a guide, but such other factors as food consumption patterns and contribution to the total diet also must be considered
Developing new or modified food products	Provide guidance in establishing nutritional levels for new food products	Use in combination with information on probable products; use within the context of the total diet
Clinical dietetics	Develop therapeutic diet manuals	Use to assess the nutritional quality of modified diets
	Plan modified diets	Use as a starting point along with information on the patient's nutritional status and individual needs
	Counsel patients requiring modified diets	Use as one basis for advice on food selection
	Plan menus and food served in institutions for the developmentally disabled	Use as a starting point, but modify for individual's developmental status and body size
Nutrient supplements and special dietary foods	Use as a basis to formulate supplements and special dietary foods	Use as a basis in developing infant formulas and other oral supplements or foods, but also consider nutrient bioavailability and nutrient balance; cannot be used as the only guide for parenteral feeding products

SOURCE: Adapted from *Uses of the Recommended Dietary Allowances*, unpublished manuscript, 1983.

Although some nutrition professionals question the need for RDAs, most would agree that some type of nutrient-based standard is necessary. The RDAs have become so integral to food and nutrition policy in the United States that it is difficult to conceive of planning a food program or changing a nutrition policy without considering how either would affect the population's dietary intakes expressed in relation to the RDAs.

Since 1941, the Food and Nutrition Board (FNB) has issued reports periodically providing "standards to serve as a goal for good nutrition." Successive editions of the *Recommended Dietary Allowances* provided intakes of specific levels of several essential nutrients by age group, sex, and as appropriate, physiological state. These levels are judged on the basis of available scientific evidence to meet the known nutritional needs of practically all healthy persons in the United States.

Concurrent with the expansion of knowledge of the biochemical function of specific nutrients, knowledge of how diet influences the risk of chronic diseases has also increased. In 1989, the FNB released *Diet and Health*, a major review of the evidence relating dietary patterns, food consumption, and nutrient intake to the development of chronic diseases that are the primary causes of morbidity and mortality in the United States (NRC, 1989a). These include atherosclerotic cardiovascular diseases, hypertension, obesity and eating disorders, cancers, osteoporosis, diabetes mellitus, hepatobiliary disease, and dental caries. Topics covered in the report encompassed total macronutrient intake, energy expenditure and net energy stores, fats and other lipids, proteins, carbohydrates, dietary fiber, fat-soluble vitamins, water-soluble vitamins, essential minerals and trace elements, electrolytes, alcohol, coffee, tea, and dietary supplements.

The FNB now faces the challenge of whether to bring together the concepts of a health-promoting diet to reduce the risk of chronic disease and the nutrient-specific concepts underlying the RDAs. In 1992, the FNB began the first phase of what it envisioned to be a two-phase project leading to an eleventh edition of the RDAs. In phase I, the FNB would determine if there were compelling reasons to revise the tenth edition; if the answer was yes, it would begin phase II—develop an approach, strategy, and scope of work for the study. The task begun by the FNB in phase I was to determine whether or not the RDAs needed revision. Phase I included the symposium, public hearing, and FNB meeting in June 1993 from which it was clear that the community believed that the time had come to revise the RDAs. This concept paper represents the end of phase I and moves the FNB into phase II. Phase II would require several years and an intense level of activity that would culminate in the publication of an eleventh edition of the RDAs and possibly several derivative reports.

The FNB held a national conference, consisting of a symposium and a public hearing, in June 1993 to explore several key issues related to the future of the RDAs. Members of regulatory and other federal agencies discussed their experiences in applying the RDAs in different policy situations and identified factors limiting their usefulness. Nutrition and medical experts described new evidence attained since publication of the tenth edition that would support a change from the present values or a reexamination of the data base. Also discussed was incorporating concepts related to reducing the risk of chronic disease in the development of nutrient-specific allowances. Some speakers offered alternative formats for presenting RDAs.

Following the conference, the FNB concluded that further discussion of these issues was needed. Although there is substantial support for the revision of the current RDAs, the approach to be taken in this revision needs further development. The FNB members believe that they must develop, discuss, and disseminate new concepts of the RDAs with the scientific and professional communities to gain widespread support and agreement on an approach before a new RDA committee is convened. Therefore, this publication was prepared to summarize the issues discussed during the conference and to propose an approach to reconceptualizing the RDAs.

Concepts Underlying the Recommended Dietary Allowances

As the United States entered World War II, the Food and Nutrition Board (FNB) was established within the National Academy of Sciences initially to advise the Army and later other government agencies on problems relating to food and the nutritional status of the U.S. population. The FNB recognized the need to develop recommendations on the amounts of nutrients that should be provided to the general public as well as to the armed forces. Therefore, it took as its first task the formulation of what came to be known as the Recommended Dietary Allowances (RDAs).

This endeavor was not undertaken in isolation. During World War I, the Food Committee of the British Royal Society developed a report on food requirements based on existing knowledge of nutritional needs (Cruikshank, 1946). Between 1925 and 1937, the Health Organization of the League of Nations published a series of documents examining aspects of food and nutrition problems, culminating in a report on estimated requirements for vitamin and mineral intake (Harper, 1987). In 1933, two sets of dietary standards were published—one by a committee of the British Medical Association (Harper, 1987; Leitch, 1942), and the second, by Hazel K. Stiebeling (1933) for use by the U.S. Department of Agriculture for developing food programs.

During the development of these early reports, two changes occurred in the way dietary standards were conceptualized. First, recommendations for starvation relief programs became standards for programs to maintain and improve the health of the population as a whole, with increasing emphasis on meeting the nutritional needs of infants, children, and pregnant women. Second, recommendations originally based on observations of usual food

consumption patterns were increasingly formulated based on scientific knowledge of human needs for essential nutrients and energy (Harper, 1987). The report of the first RDA committee reflected these new ideas for developing dietary standards.

PROCESS FOR SETTING RDAs

The first RDA committee surveyed the research literature and formulated a tentative set of values for various nutrients known at that time for persons of different age groups, for both sexes, and during pregnancy and lactation. The committee sent copies of the proposed allowances to a large group of scientists and asked for criticism and suggestions. As Lydia J. Roberts, a member of that committee, described it, "they believed that any accepted allowances should represent not just the thoughts of a small group of workers, however competent they might be, but that all persons who had done research on any factor or had other bases for judgment should have a part in their formulation" (Roberts, 1958). At that time, the size of the U.S. scientific nutrition community was about 50 people (Roberts, 1958). It is difficult to estimate the size of this community now. At least 5,000 individuals are members of primarily research-oriented nutrition societies, and a conservative estimate of the membership of other professional nutrition societies who are also involved in nutrition research would add at least an additional 20,000 scientists.

Since the original RDA committee, the FNB has developed a mode of operation that involves establishing a committee of experts who then gather needed information through a variety of mechanisms. All RDA committees rely heavily on published literature. Recent RDA committees have sought additional scientific expertise through correspondence, workshops, and special meetings with invited experts. A group of anonymous reviewers critiques every report, and the committee gives serious consideration to these appraisals.

DEFINITIONS

When the first RDA committee began its work in 1940, the concept of essential nutrients was well established. Nutrients were defined as chemical substances found in food that are necessary for human life and tissue growth and repair. Those that the body cannot synthesize were called essential (or indispensable) nutrients. The first RDAs were intended to be "a table of allowances which would represent the best available evidence on the amounts

of the various nutritive essentials desirable to include in practical diets” (NRC, 1941, p. 1).

Essential nutrients were identified when dietary deficiency led to the development of a well-defined disease or a failure to grow. The use of the animal growth model to identify essential nutrients and to quantify requirements was the foundation of experimental nutrition and a unifying technique in the development of nutrition science.

Every edition of the RDAs has made recommendations for essential nutrients. The first edition defined RDAs as dietary standards “to serve as a goal for good nutrition and as a ‘yardstick’ by which to measure progress toward that goal . . .” (NRC, 1941, p. 1). These allowances for specific nutrients were intended to serve as a guide for planning adequate nutrition. The quantities for each nutrient were formulated to provide not merely the minima sufficient to protect against actual deficiency diseases but also a fair margin above this amount to ensure good nutrition and protection of all body tissues (NRC, 1941).

The 1953 edition expanded further the concepts underlying RDAs:

The allowances are designed for the maintenance of good nutrition of healthy persons in the United States under present conditions. They are not necessarily applicable to situations of stringency or limited food supply. The recommendations are not requirements, since they represent not merely minimal needs of average persons, but nutrient levels selected to cover individual variations in a substantial majority of the population. In addition, the values for each nutrient above the minimal level which will prevent deficiency are considered to provide for increased needs in times of stress and to permit other potential benefits. Although the optimal intake of essential dietary constituents remains largely speculative, there is considerable evidence that improvement in growth and function occurs when the intake of certain nutrients is increased above the level just sufficient to prevent signs of deficiency disease (NRC, 1953, pp. 1–2).

From this description, it is evident that as early as 1953, an RDA committee was considering the potential health benefits of nutrient intakes above minimum requirements.

The 1974 edition established the definition of RDAs that has remained in effect through the tenth edition. RDAs “are the levels of intake of essential nutrients considered, in the judgment of the Food and Nutrition Board on the basis of available scientific knowledge, to be adequate to meet the known nutritional needs of practically all healthy persons” (NRC, 1974, p. 2).

In summary, all ten editions have defined the RDAs on the same basis. They are set for essential nutrients, at levels to cover individual variations in requirements, and to provide a margin of safety above minimal requirements.

The early editions included discussions of why the term “recommended dietary allowances” was chosen rather than “standards.” The term “recommended allowances” was preferred because the values were tentative and based on a growing research base. The FNB adopted the term “recommended dietary allowances” to avoid any implication of finality or that the allowances represented minimal or optimal requirements. Studies with animals indicated that the amounts of some nutrients sufficient to provide health for short portions of the life span might be inadequate to maintain good health throughout life (NRC, 1948). The first RDA committees had to contend with the fact that the various studies of nutrient requirements on human subjects available at that time had lasted no more than 6 to 9 months. Nevertheless, the committees established allowances that they judged to be generous enough to meet adequately the nutritional needs of average persons over both short and long periods of time.

As new substances in food were recognized as being essential and as sufficient data accumulated on requirements, these substances were added to the RDA texts. The 1943 edition made recommendations for energy, protein, two minerals (calcium and iron), and six vitamins (vitamins A, C, and D; thiamin; riboflavin; and niacin). The RDA table in the 1989 edition had expanded to include five additional vitamins (vitamins E, K, B₆, and B₁₂ and folate) and five additional minerals (phosphorus, magnesium, zinc, iodine, and selenium). In addition, “safe and adequate daily dietary intakes” were established for two vitamins (biotin and pantothenic acid) and five minerals (copper, manganese, fluoride, chromium, and molybdenum). This latter category was established in the ninth edition (1980) for essential nutrients for which data were sufficient to estimate a range of requirements but were insufficient for developing an RDA.

As the specific biochemical functions of nutrients were elucidated and techniques were developed to assess body pool sizes, the criteria used to determine RDAs reflected this new knowledge. For example, until 1974 the RDA for thiamin was based on levels of dietary thiamin that would prevent clinical signs of deficiency and that would produce measurable levels of thiamin metabolites in urine. In the 1974 RDAs, maintaining transketolase activity was introduced as a third criterion for establishing that RDA.

CRITERIA FOR ESTABLISHING RDAs

RDA committees since 1974 have commented on the ideal method for establishing allowances. For a given nutrient, this would involve selecting healthy people who represent the segments of the population for which allowances were to be set, determining their average requirement, assessing

statistically the range of individual variability, determining the range of bioavailability/biological value in commonly consumed foods, and then calculating an allowance to cover their needs.

The requirement for any nutrient has been defined as the minimum intake that will maintain normal function and health. In infants and children this has been equated to the amount that will maintain satisfactory growth rates. The adult requirement has been the amount that will maintain body weight and prevent depletion of the nutrient from the body as judged by balance studies or maintenance of blood and tissue concentrations. Six types of evidence are used in establishing RDAs:

- nutrient intakes observed in apparently normal, healthy people,
- epidemiological observations of populations in which the clinical consequences of nutrient deficiencies are corrected by dietary improvement,
 - balance studies that measure nutrient status in relation to intake,
 - nutrient depletion/repletion studies in which subjects are maintained on diets containing marginally low or deficient levels of a nutrient, followed by correction of the deficit with measured amounts of that nutrient (such studies are undertaken in humans only when the risk is minimal),
 - extrapolation from animal experiments, and
 - biochemical measurements that assess the degree of tissue saturation or adequacy of molecular function in relation to nutrient intake.

The 1989 edition notes that if the distribution of nutrient requirements followed a normal or Gaussian distribution, the most straightforward way for establishing an allowance would be to calculate the population mean requirement and increase it by two standard deviations. This would cover the needs of 98 percent of the population. However, the distributions of requirements for nutrients, with the possible exceptions of protein, vitamin A in adults (NRC, 1980), and iron in menstruating women (FAO, 1988; Health and Welfare Canada, 1983) are not known. RDA committees still generally assume a normal distribution but use a four-step process to calculate allowances:

- Agree on the basis for determining nutrient status.
- Estimate the average requirement and the variability in the requirement for a given population.
 - Determine the allowance by increasing the average requirement by an amount sufficient to meet the needs of nearly all members of the population.
 - For some nutrients, increase the allowance to account for inefficient body use of the nutrient as consumed (e.g., poor absorption or poor conversion of precursor to active forms).

For each step, when information is limited, scientific judgment is used. The use of scientific judgment usually results in the use of safety factors to ensure that the needs of people in the United States are met. When safety factors are used, it is necessary to provide information on the derivation of these factors and their application to estimating the recommended values.

PHARMACOLOGICAL EFFECTS

Recent RDA committees have commented on the use of nutrients at levels many times the RDA to attain health effects unrelated to the functional roles associated with levels achievable through dietary means alone. Some examples of these pharmacological effects include nicotinic acid, which when taken in doses of up to 9 grams daily, reduces serum lipids; vitamin A analogues, which are used to treat skin disorders; and antioxidant nutrients such as vitamins C and E, which some epidemiological data suggest may reduce the risk of coronary heart disease. The committees have categorized these as “pharmacological effects” because even at moderately excessive intakes, interactions among nutrients can result in adverse effects. Three additional reasons for this categorization are:

- “Doses greatly exceeding the amount of a nutrient present in foods are usually needed to obtain a therapeutic response.
- The specificity of the pharmacological action is often different from the physiological function.
- Chemical analogues of the nutrient that are often most effective pharmacologically may have little or no nutritional activity” (NRC, 1989b, p. 14).

HEALTH MAINTENANCE, REDUCTION OF DISEASE RISK, AND DIET

Despite modifications in the definition of RDAs over time, the underlying intent of the RDAs has always been to prevent deficiency diseases and promote health through provision of an adequate diet. In fact, the first three editions of the RDAs included diet plans that met the allowances, similar in concept to USDA food guides.

Beginning in the early 1960s, various sets of dietary guidelines intended to help the population reduce its risk of certain chronic, degenerative diseases were developed and disseminated widely. For example, *Dietary Goals for the United States* (U.S. Senate, 1977), developed by the Senate Select Committee

on Nutrition and Human Needs, and *Dietary Guidelines for Americans* (USDA/DHHS, 1990), developed since 1980 by the Departments of Agriculture and Health and Human Services, offer qualitative advice to the public about nutritional aspects of chronic disease reduction. These guidelines are different from the RDAs, which provide quantitative information, used primarily by professionals, on specific amounts of nutrients needed to prevent deficiency diseases and maintain adequate health. Both the RDAs and dietary guidelines are the appropriate basis for diet planning (NRC, 1989b). This has led some nutrition scientists to argue that these two types of dietary advice should be brought together. However, others argue that they should remain separate due to the different purposes and audiences for which dietary guidelines and RDAs are intended and the scientific data on which they are based. With this concept paper, the FNB seeks to address, with the help of the scientific community, whether it is possible and desirable to bring these two types of advice together.

Members of RDA committees have always stressed the need to read the reports' text to interpret their tables, and this is particularly true with respect to the RDAs and chronic disease risk reduction. While the values in the tables are based on studies of nutritional requirements, the texts often gave additional advice. The texts of early editions spoke about the role of the RDAs in maintaining good health, and the 1958 edition contains the clearest statement of the relationship between the RDAs and health promotion: "The final objective of the recommended allowances must be to permit and to encourage the development of food practices by the population of the United States which will allow for greatest dividends in health and in disease prevention" (NRC, 1958, p. 28).

The 1958 RDA is also the first edition to contain a specific statement about excessive intake of dietary fat and its potentially harmful health effects. Recognizing the high mortality rate from coronary artery disease and the high levels of calories derived from fat in the United States, the committee concluded that "it is not yet possible to state definitely a reasonable allowance for fat in the diet or to indicate the characteristics of a fatty acid mixture most favorable for the support of health" (NRC, 1958, p. 19). The committee for the next edition went further to state that "for many Americans, moderate reduction in total fat and some substitution of polyunsaturated for saturated fat may be indicated" (NRC, 1964, p. 30). Based on the growing evidence that sedentary lifestyles contribute to arterial disease, obesity, and diabetes mellitus, the committee writing the 1968 edition concluded that "a higher level of health would be reached if the population were more physically active" (NRC, 1968, p. 3). The committee also reviewed the literature on fat metabolism and its relationship to coronary heart disease. Recognizing that diets high in polyunsaturated fatty acids reduce plasma cholesterol levels in hypercholes-

terolemic subjects, it reached the same tentative conclusion as did the previous committee.

In the 1974 edition, the committee concluded that individuals at risk of coronary heart disease should adopt dietary modifications to lower their serum cholesterol concentrations. It recommended that individuals follow what was then the American Heart Association's recommendations to reduce dietary fat to 35 percent of kcal derived from fat, of which less than 10 percent should come from saturated fatty acids, no more than 10 percent from polyunsaturated fatty acids, and the remainder from monounsaturated fatty acids. The committee concluded that "this would probably provide a diet conducive to better health in the United States population" (NRC, 1974, p. 36).

The 1980 edition provides specific guidance on desirable amounts and proportions of dietary fat and carbohydrate, stating that "there is sufficient evidence to support some recommendations for dietary changes that would be consonant with better health" (NRC 1980, p. 35). At the same time, it offers guidelines for individuals at high risk for certain chronic diseases. The guidelines include reducing dietary fat to less than 35 percent of energy, decreasing saturated fat levels, and increasing polyunsaturated fatty acids to more than 10 percent of dietary energy.

In the most recent edition, the authors refer to the recommendations of the FNB Committee on Diet and Health to reduce the recommended calories from fat to 30 percent or less. They also discuss dietary fiber, carotenoids, and vitamin C in relation to reducing the risk of chronic disease.

CONCLUSION

As indicated by this review, nutrition science, similar to all scientific endeavors, is rapidly changing and evolving. Nutrition scientists and practitioners continue to learn more with each passing day about nutrition and its effect on health. The role of the RDAs at any time is to provide the best consensus of nutrition science interpreted into recommended values *at that time*. The FNB believes that the science of nutrition has advanced significantly, and the next edition of the RDAs will need to reflect this progress. One consideration is expanding the RDA concept to include reducing the risk of chronic disease.

If the criteria for setting the RDAs are broadened to encompass the reduction of risk of chronic diseases, an assessment of the strength of the data supporting a nutrient's role in reduction of disease risk would need to be made based on criteria such as those used in the *Surgeon General's Report on Nutrition and Health* (DHHS, 1988) and the FNB report *Diet and Health* (NRC, 1989a):

- strength of association, usually expressed as relative risk,
- dose–response relationship,
- temporally correct association, with exposure preceding the onset of disease,
- consistency of association in a variety of studies,
- specificity of association, and
- biological plausibility.

If reduction of risk of chronic disease is to become a criterion in the development of future RDAs, many questions must be faced. Among them are central questions about what the RDAs are meant to be: Are they levels of intake based on requirements for specific biochemical functions? Are they based on less specific physiological outcomes possibly related to multiple functions? If the answer is “yes” to both, then it is possible and may be desirable to provide multiple recommendations based on different functional endpoints. Additional questions include the following: What criteria should be used to set recommended levels of intake when clinical trial data are lacking? What is the desirable level of intake over a lifetime? How can desirable levels of intake be extrapolated for groups not included in clinical trials (such as children, adolescents, young adults, and the elderly)? Should levels of nutrient intake be expressed in terms of numerical ranges, in terms of food patterns, or in some other way? Under what conditions do the functions of nutrients consumed at levels above the amounts obtainable from food become pharmacological agents outside the domain of the RDAs? How can concerns regarding potential interactions among nutrients be addressed?

Future Directions for the Recommended Dietary Allowances Under Discussion by the Food and Nutrition Board

A CONCEPTUAL APPROACH FOR THE RDAs

When the FNB began considering whether the RDAs should be revised, it recognized the need to increase the participatory process. The FNB is gathering information and opinions about the need for revising the RDAs through four mechanisms—(1) prepared talks from researchers invited to participate in a symposium held in Washington, D.C., June 28–29, 1993; (2) oral testimony delivered during the subsequent open hearing; (3) written testimony; and (4) participation in meetings sponsored by other organizations. The opportunity to comment at the symposium and hearing was advertised, and 25 individuals and organizations provided oral testimony and 19 submitted written testimony (see Appendix A). The information gleaned from the conference symposium and public hearing is summarized in Appendix B. This testimony is organized according to the five questions posed that formed the basis for the symposium. The appendix closes with a list of opinions presented that pertain to the process itself. The FNB has reviewed all written and oral comments. These will remain part of the data base the FNB is developing to include in further deliberations.

Last June's symposium and public hearing provided a forum for scientists, advocates, and involved professionals to present the FNB with their viewpoints on issues pertaining to the future of the RDAs. The FNB reviewed the information and developed three general conclusions from it:

(1) Sufficient new knowledge has accumulated for selected nutrients, especially energy and several vitamins and minerals, that supports a review of the current RDAs.

(2) Reduction in the risk of chronic disease is a concept that should be included in the formulation of future RDAs where sufficient data for efficacy and safety exist.

(3) Serious consideration must be given to developing a new format for future RDAs.

The FNB believes that the basic purpose of the RDAs remains valid, that is, “to provide standards to serve as a goal for good nutrition” (NRC, 1941). Given the research on which RDAs are based, RDAs are meant to be applied to groups of healthy people and not individuals. They are therefore set at levels that exceed the needs of most people to encompass the individual variability in nutrient requirements. In practice, however, most nutritionists would translate the purpose of the RDAs to be the levels of essential nutrients that *healthy individuals* should consume on average over a period of time to *ensure adequate and safe nutrient intakes*. One task of a new RDA committee will be to provide practitioners and interested laypersons with guidance on the appropriate ways in which RDAs might be used to evaluate the nutrient needs of individuals.

If no change were to be made in the basic purpose of the RDAs, the FNB would plan to revise RDAs for individual nutrients as the body of scientific evidence accumulates. In this way, specific chapters could be revised and widely disseminated along with an updated table, but the entire text would be revised less frequently than has been the case in the past.

The FNB members feel strongly that future RDA documents need to provide more detail about the derivation of the recommendations and more explicit guidance in using the values for policy and other uses. Specific approaches need to be developed and tested for using available data to derive several reference points for intake of essential and other important food components that influence the risk of chronic disease. In addition, it would be critical to identify where data were insufficient for judgments to be made about the reference points and to make recommendations for research to fill these gaps. These reference points could provide a systematic way of organizing the scientific literature and identifying the strengths and weaknesses of existing data. In the judgment of the FNB, possible reference points (as illustrated in Figure 1) could be defined as follows:

- **Deficient**—Level of intake of a nutrient below which *almost all healthy people* can be expected, over time, to experience deficiency symptoms of a clinical, physical, or functional nature.

- **Average Requirement**—Mean level of intake of a nutrient or food component that appears, on the basis of experimental evidence, sufficient to maintain the desired biochemical/physiological function *in a population*. It is also important to know the variation in the mean requirement.

- **Recommended Dietary Allowance**—Level of intake of an essential nutrient or food component considered on the basis of available scientific knowledge, to be adequate to meet the known nutritional needs of practically *all healthy persons*. There will be a continuing need to redefine numerical recommendations. For some nutrients, other functional endpoints might be defined and included as criteria for the definition of recommended intakes.

- **Upper Safe**—Level of intake of a nutrient or food component that appears to be safe for *most healthy people* and beyond which there is concern that some people will experience symptoms of toxicity over time.

These multiple reference points would incorporate some aspects of the approach adopted by the Committee on Medical Aspects of Food Policy (COMA) of the United Kingdom in its 1991 report on Dietary Reference Values (DRVs) (COMA, 1991). The DRVs consist of three values. The first is the Estimated Average Requirement (EAR), which is the average requirement of a nutrient as shown in various study populations. The two other values are based on an assumption of normal distribution of nutrient requirements in

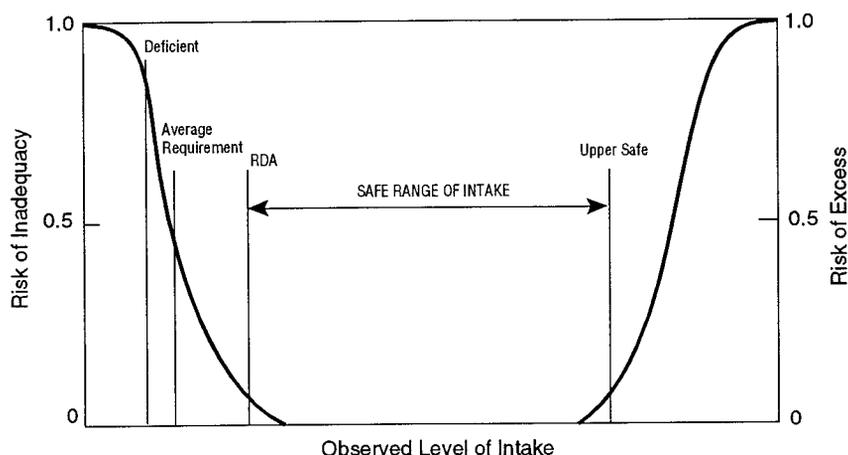


FIGURE 1 The concept of a safe intake range. The safe intake range is associated with a very low probability of either inadequacy or excess for an individual selected at random from the population. Adapted from Health and Welfare, Canada, 1983.

a population, with the understanding that information is usually inadequate to calculate the precise distribution of requirements. The Lower Reference Nutrient Intake is a value two standard deviations below the mean requirement and represents the lowest intake that will meet the needs of some individuals. In contrast, the Reference Nutrient Intake (RNI) is the value two standard deviations above the mean requirement. The RNI—which represents the amount of a nutrient sufficient or more than sufficient to meet the needs of most healthy people—is essentially equivalent in concept to the current RDAs of this country. In addition to DRVs for vitamins and minerals, the COMA report recommends intakes for several other dietary components—such as starches, sugars, fats, and fatty acids—where no precise requirement (or EAR) can be defined. The recommended intakes for these components are derived by a different process than that used for vitamins and essential minerals, one COMA describes as “pragmatic judgments” (p. 2) that represent intakes “consistent with good health, given the prevailing socio-cultural environment” (p. 13).

The FNB faces many challenges in developing its proposed approach. A future committee charged with this task and reviewing the literature would need to deal with suggestive, but incomplete, information on the potential for nutrients to reduce the risk of chronic disease and the amounts required to provide these effects; on the effective dose (analogous in concept to the average requirement); on the variability in the effective dose; on the chronic toxicity of large doses of nutrients; and on potential nutrient interactions. Of particular concern is the general lack of information on children, youths, and young adults. This information is required to develop recommendations that may affect longevity, health, and chronic disease. Most of the research to date on the reduction of risk of chronic disease is based on studies of middle-aged and older adults.

A PLAN FOR THE NEXT RDAs

The FNB believes that future RDAs will need to have more flexibility to address multiple uses. The FNB recognizes that the present RDAs are not well suited for some applications (as shown in Table 1), for example, using RDAs for the nutritional labeling of foods requires that a single value for each nutrient be established as a standard. To meet the broad range of needs of users of the RDAs, the FNB proposes to develop a series of three publications.

One publication, an eleventh edition of the RDAs, would review what is known about essential nutrients and important food components with respect to the four proposed reference points: deficient, average requirement, recommended dietary allowance, and upper safe levels. In addition, a new

RDA committee would address, in the text of the report, issues of nutrient–nutrient interactions and the potential roles of nutrients and other food constituents in reducing chronic disease risk. The committee would review the literature in these areas for each nutrient or relevant constituent and give guidance on when and under what conditions it might be appropriate for certain individuals or population groups to strive for intakes that deviate from the RDAs.

A second publication would describe how the new RDAs could be used for the variety of purposes to which they are put. The traditional uses of the RDAs would be covered in this document. A third publication, intended for the public, would explain the principles and scientific evidence underlying the RDAs and present them in terms of dietary patterns for persons of specific age and physiologic states. It would also include recommended dietary patterns for population subgroups based on considerations of age, race, and ethnic dietary preferences. To contain costs, these three reports would be developed sequentially using a series of small committees overseen by a committee of FNB members.

The FNB would maintain this open process for developing future RDAs, by implementing new mechanisms to obtain wider participation. In addition to reviewing the literature, holding invitational workshops, and corresponding with experts, FNB members are considering new ways to obtain comments on the conceptual development of the RDAs and to evaluate the adequacy of the literature. Public meetings structured around the findings of the committee with respect to different controversial nutrients, symposia held in conjunction with professional society meetings, and research review monographs published for public comment will be planned to increase the involvement of the nutrition community.

With this concept paper, the FNB presents its initial ideas for a new approach to the RDAs. The FNB seeks constructive criticism, suggestions, and substantiated rebuttal so that our approach can be reviewed and modified. To advance this process, symposia are scheduled at nutrition-focused scientific meetings through 1994 to debate several of the outstanding issues discussed in this paper (see Appendix C for details). The FNB urges readers of this report to submit written remarks to the address below. Please include full literature citations and supporting documentation wherever appropriate.

The FNB looks forward to working with the interested nutrition community in determining the future of the RDAs.

Send comments to: RDA Comments, Food and Nutrition Board, Institute of Medicine/NAS, 2101 Constitution Avenue, N.W., Washington, D.C. 20418

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A

Speakers and Commenters

On June 28–29, 1993, the Food and Nutrition Board, Institute of Medicine, sponsored a workshop and public hearing, *Should the Recommended Dietary Allowances Be Revised?* The two-day meeting was sponsored by funds from the National Academy of Sciences and the Kellogg Endowment Fund. It was held at the National Academy of Sciences Auditorium in Washington, D.C. Notification of the meeting was widely publicized to encourage the participation of concerned individuals and groups. The invited speakers and names of individuals who presented oral and written testimony at the symposium are included in this appendix.

SPEAKERS

COL Wayne Askew
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San Francisco, California

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Council for Responsible Nutrition

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Health & Welfare Canada

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Elaine Monsen, Ph.D.
University of Washington

Edward Scarbrough, Ph.D.
Food and Drug Administration

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University of Nevada

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Anthony Iannarone
Hoffmann LaRoche

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Suzanne Oparil, M.D.
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Donna Porter, Ph.D.
Library of Congress

Kenneth M. Rosenberg
Pharmavite Corporation

David Schardt
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Interest

Paul A. Stitt
Natural Ovens of Manitowoc

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Dr. Bernard F. Szuhaj
Central Soya Company, Inc.

John Weisburger, M.D.
American Health Foundation

PERSONS PRESENTING WRITTEN TESTIMONY

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Chester, New Jersey

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John H. Weisburger, Ph.D., M.D.
American Health Foundation

B

Need for Change Voiced by the Scientific and Advocacy Communities

SUMMARY OF COMMENTS AND TESTIMONY

QUESTION 1: *What Has Been the Experience Applying the RDAs in Different Situations, and What Factors Limit Their Usefulness?*

Invited speakers representing government agencies and industries that rely on the RDAs noted that the RDAs are used to plan and procure food supplies for population subgroups, interpret food consumption records for individuals and populations, establish standards for food assistance programs, evaluate the adequacy of food supplies in meeting nutritional needs, design nutrition education programs, develop new products in industry, and establish guidelines for nutrition labeling of foods. By serving as the independent standards of nutritional adequacy, the RDAs play an important role in determining meals served in hospitals, nursing homes, prisons, publicly run residential care institutions, and other places where the participants' nutritional status and health are likely to be marginal. The RDAs act as independent guideposts for developing nutritional standards for federal food assistance programs and serve to protect the nutritional integrity of these programs.

The invited speakers raised concerns about limitations of the RDAs when used for these different applications. These include the incompleteness of the scientific base used to determine the RDAs, uncertainties about the biological variability in requirements that exist among individuals, and limitations that result from the focus on the traditional concern of preventing deficiency disorders. Several other limitations identified were the lack of additional age-specific recommendations for individuals over the age of 51, a group that is

becoming an increasingly larger proportion of the population; lack of sufficient emphasis on the range of appropriate macronutrient intakes; lack of relevance to chronic disease and the concomitant need to address dietary fat, fiber, and some vitamins; lack of information that addresses nutrient needs over the life cycle; little consideration of nutrient interactions; and lack of consideration for varying activity levels. Moreover, since the RDAs build in a margin of safety, some individuals were concerned that actual requirements are overestimated, making it difficult to determine at what levels of intake a population is truly at risk.

Several speakers commented that perhaps the RDAs are attempting to fulfill too many purposes. They argued that professionals and the public may be better served by having several levels of dietary allowances established to address different needs and purposes. One suggestion was that more than one set of guidelines be developed, similar to the approach taken by the United Kingdom (U.K.) (COMA, 1991). The U.K. approach includes developing three values for each nutrient: a low value estimating a deficiency state, a value representative of the population's average requirement, and a third value analogous to the current RDA and approximately two standard deviations above the average requirement. Others additionally recommended setting an upper safe level of intake that would be established where undesirable health effects are likely to occur in the population as a whole.

Several requested that consideration be given to developing a separate set of RDAs for use in food labeling, while cautioning that frequent changes in the RDAs would pose financial hardships to industry. One individual urged that international harmonization be considered if the FNB were to develop an RDA for food labeling purposes.

Throughout the testimony, many individuals emphasized the need for additional documentation to explain the derivation of the numbers and to facilitate their appropriate applications. Additional documentation would describe the state of knowledge concerning the levels of nutrients and food components needed for health promotion and disease prevention, to provide guidance to professionals who are using the RDAs for a variety of applications, and to identify gaps in knowledge so research priorities can be established. A suggestion was made to merge dietary guidelines with the RDAs to promote one consistent message to the public and to provide this information for the public's use in a less scientific and more accessible publication than the traditional RDA text.

QUESTION 2: *What New Evidence Would Argue for a Change from the Present Values or a Reexamination of the Evidence?*

There was general agreement that an RDA committee should be established to review new data available since publication of the tenth edition in 1989. The viewpoints expressed regarding specific revisions can be divided into three areas: recommendations for an increase in an existing RDA, recommendations for a decrease in an existing RDA, and recommendations for establishing a new RDA for a particular nutrient or food component not currently covered.

One or more commenters concluded that sufficient data have accumulated that would argue for increasing the RDAs for folic acid, calcium, vitamin D, and the antioxidant vitamins (ascorbic acid and vitamin E) for at least some age and sex categories. The new data they cited indicate a role for folic acid in reducing the risk of neural tube defects, for folic acid and antioxidant vitamins in reducing the risk of some cancers, and for calcium and vitamin D in increasing bone mass accretion among children and adolescents and preventing bone loss in adults.

Others expressed the opinion that the RDAs for caloric intake, protein, and iron might be lowered in light of new data. These commenters stated that doubly labeled water and indirect calorimetry experiments indicate that energy requirements among some age groups may be lower than currently estimated. Similarly, it was voiced that protein requirements for children and for adults need to be reviewed. The possible adverse effects of iron as a catalyst for oxyradical formation and facilitator of other oxidation processes were cited as potential justification for lowering the iron RDA for some age and sex categories.

Various commenters expressed views that sufficient data were available now to set RDAs for nutrients and food components that are not currently addressed in the tables. These include beta-carotene, omega-3-fatty acids, sodium, choline, dietary fiber, and macronutrients in light of data on their roles in reducing the risk of cancer, cardiovascular disease, and other chronic diseases. Several speakers commented that the recommendations for sodium need to be reviewed; that the interrelationships between sodium and potassium, calcium, and magnesium be studied; and that sodium restriction should be evaluated in terms of safety and effectiveness in preventing hypertension.

QUESTION 3: *Should Concepts of Reduction of Risk of Chronic Disease Be Included in the Development of Allowances?*

The majority, though not unanimous, view expressed by speakers and testifiers was that concepts of risk reduction for chronic disease should be

included in developing the RDAs. Several individuals expressed the opinion that when sufficient data are unavailable to establish an RDA but the emerging trend indicates that certain nutrients have physiological or biochemical implications for health, that emerging information should be communicated, and the recommended levels should reflect an adequate and safe range of intake.

A small number of commenters argued that the RDAs should remain distinct from dietary guidelines for reducing the risk of chronic disease. They emphasized that the purposes of the RDAs and the dietary guidelines are very different and that there was a less adequate data base for formulating recommended allowances for reducing the risk of chronic disease. The necessity for a nutrient standard for narrower nutritional applications, such as food labeling, also was mentioned.

QUESTION 4: *How Should Recommended Levels of Intake Be Expressed?*

In considering how recommended levels of intake should be expressed, the FNB asked whether individual values should be given for different age and sex categories or whether ranges of recommended intakes should be provided, how the ranges should be defined, and whether toxic levels should be included where data are sufficient to establish an upper limit. Most respondents favored ranges rather than a single value because ranges allow differences among individuals and groups, give more recognition to the biological heterogeneity among individuals, and dispel the notion that the numbers recommended represent exact requirements. However, presenting RDAs as ranges would make it complicated to use them in government programs if advice is lacking about what point in the range is appropriate for different applications.

Although most commenters favored the use of ranges, they expressed many different opinions about the appropriate reference points to comprise any range. Some favored defining an upper limit for any nutrient as something less than a toxic level, representing the level of intake associated with maximum health promotion. Some favored defining a middle range as the average requirement while others suggested that the midrange of the level be associated with lowest disease risk. Most agreed that the lowest point in the range should represent the level of intake associated with a high risk for deficiency.

QUESTION 5: *Is Knowledge of Relationships among Nutrients Sufficient to Consider when Establishing the RDAs?*

Very few comments were received on this question. This lack of response probably reflects the relative lack of knowledge of nutrient interactions for most vitamins, minerals, and food components. Two invited speakers provided

an overview of the state of knowledge of nutrient bioavailability. They were asked to discuss whether available data are sufficient to permit the use of bioavailability algorithms in establishing the RDAs, an approach used with iron in recent RDA editions. These speakers indicated that a similar approach could be considered for several other nutrients where the data base is sufficient.

TESTIMONY RELATED TO THE MECHANISM TO ESTABLISH RDAs

Several testifiers addressed the mechanism for developing new RDAs. These comments are summarized below:

- List index nutrients that if consumed in adequate amounts, would ensure the adequate consumption of all other food components.
- Relinquish the task of revising the RDAs to groups of scientists in a university setting or to professional societies.
- Create an office in the Department of Health and Human Services to establish a new conceptual basis for the RDAs, revise the RDAs, and facilitate their use by the public. Once this is done, the Assistant Secretary for Health should use health, medical, and nutrition professionals; consumers; and industry representatives to oversee the development of new RDAs. Form expert panels of individuals with specific training and experience to devise a particular nutrient recommendation. Once the RDAs are revised, expend considerable efforts to promote healthful diets to the public and health care providers.
- Establish an ongoing RDA committee to ensure that the RDAs are current and that major professional users are informed of potential considerations for revisions.
- Support ongoing efforts to evaluate the needs for revising current RDAs. Praise was given to the proposed method for setting the RDAs and for reaching out to groups of workers expert in various aspects of each nutrient and health factor relative to the establishment of recommendations.
- Support legislation in the U.S. Congress that would require the FDA to revise the RDAs.
- Consider supporting the additional fortification of food as a useful way of delivering nutrients to the public. This was proposed to encourage the consumption of wholesome foods to meet nutritional needs rather than promote the use of supplements.

C

RDA-Related Symposia Scheduled at Professional Meetings in 1994

AMERICAN SOCIETY FOR PARENTERAL AND ENTERAL NUTRITION

Date: February 2, 1994, 8:00–10:00 a.m.

Place: San Antonio, Texas

Speakers: K. Michael Hambidge, F.R.C.P., Sc.D.
Richard Atkinson, M.D.
Ronnie Chernoff, Ph.D., R.D.

AMERICAN INSTITUTE OF NUTRITION/AMERICAN SOCIETY FOR CLINICAL NUTRITION

Date: April 24, 1994, 4:00–6:00 p.m.

Place: Anaheim, California

Speakers: Lindsay Allen, Ph.D., R.D.
John Beard, Ph.D.
Robert M. Russell, M.D.

INSTITUTE OF FOOD TECHNOLOGISTS

- Date: June 28, 1994 (afternoon)
- Place: Atlanta, Georgia
- Speakers: John W. Erdman, Ph.D.
Jesse F. Gregory, Ph.D.
Patricia A. Kreutler, Ph.D.
Fred R. Shank, Ph.D.
- Sponsors: IFT Nutrition Division and IFT/NAS Liaison Committee

AMERICAN DIETETIC ASSOCIATION

- Date: October 17–20, 1994 (exact date and time to be determined)
- Place: Orlando, Florida
- Speakers: Janet King, Ph.D., R.D.
Sachiko St. Jeor, Ph.D., R.D.
Laura Sims, Ph.D., R.D.