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NEW DIRECTIONS IN DIETARY GUIDANCE

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Standards for nutrient intake are largely based on the "Recommended Dietary Allowances" of the National Research Council Food and Nutrition Board. But while that publication generally considers nutrients, people obviously consume foods. The consumer who wants to make intelligent food choices must, therefore, make a transition from recommended nutrient intake to recommended food intake. Additionally, as consumers confront a more and more complex food supply, their choices become more difficult.

To meaningfully interpret nutrient allowances, an individual must know the nutrient compositions of the foods that are eaten. A direct comparison between what nutrients are in a particular food and what nutrients are needed by those who consume it gives a measure of food quality. By extending this approach, the adequacy of the national (or even world) food supply, and the nutritional health and status of those who consume that food, can be determined.

Clearly, the published "Recommended Dietary Allowances" deals with nutrients, and the important consumer questions ultimately relate to food choices. Furthermore, previous editions of the "Recommended Dietary Allowances" have focused attention on only part of those nutrients which are known to be required by humans. The 1979 edition increases the number of nutrients for which recommended allowances are given. But even as it does, consideration of the energy yielding components of the diet—fat and carbohydrate—while expected to be enlarged in comparison with previous editions, will still be far too limited for the purposes described above.

Consider that the consumption of fat as a proportion of calories has increased since the turn of the century to a point where fat may now provide 40 to 42 percent of all calories. This increase in fat consumption has largely involved vegetable oils, with the consumption of fats from animal sources (butter and lard) declining substantially during that same period. In conjunction with this increase in proportion of calories from fat, the consumption of foods containing complex carbohydrates, such as starch and fiber, has declined.

The consumption of alcoholic beverages as a proportion of calories is increasing. Enough beer, distilled spirits, and wine are being consumed to add approximately 200 calories per capita from alcohol as the average daily intake for everyone over age 14. If only half of the population consumed alcohol, that would mean about 400 calories per person from alcohol. Furthermore, if these choices are beer and wine, even though some additional nutrients are contributed, the nutrient density is low and the additional nonalcohol calories from beer almost double the calorie intake, and from wine are substantially increased.

For years, protein intake has been emphasized in technical and popular publications, and its practical importance may be overestimated in the public's mind. The results include an imbalance in education programs and an effort by segments of the food industry to promote high-protein foods and even protein supplements. Few would deny the important role that protein plays in the diet. In the United States, however, our average protein consumption is generally adequate, and rarely can an individual be found who is malnourished because of an inadequate consumption of protein.

While food consumption has changed since the turn of the century, so, too, has the activity pattern of the average American, resulting in a diminished requirement for energy from food. At the turn of the century, a high proportion of the population was engaged in the production of food, work that was highly demanding of physical effort. Now fewer than 5 percent of the population produces food. As we have become more sedentary, we have also become older as a population, again greatly reducing individual calorie needs. Indeed, many of us, especially women and older people, are consuming fewer than 2,000 calories per day. This suggests that, in order to meet the recommended dietary allowances, more care must be exercised in selecting foods. The consumption of foods high in fat, sugar, and alcohol must be restricted in the diet in order to meet nutrient needs within a limited calorie intake.

Recently, some notable attempts have been made to assess food and diet quality, and to publish the results as a way to enlighten the public and help people make the necessary transitions from nutrients to food. One example is the two editions of "Dietary Goals" developed by a Senate committee. Others include a major section of the Surgeon General's report, "Healthy People," and a segment of the publication from the Center for Disease Control, "Promoting Health and Preventing Disease." All of these documents may, in part, trace their origin to the increasingly vociferous interest of consumers in personal health issues and their desire to transpose recommended dietary allowances for nutrients into meaningful recommendations for food consumption.

What could be most helpful at the present time is an objective determination of the available information and the development of realistic and meaningful dietary guidelines to enlighten food choices. The National Academy of Science Food and Nutrition Board presumably has the creditability, but its members have been reluctant or unwilling to exercise it. This Board has persisted in its focus on nutrients, while saying little or nothing about food choices.

Why do people need such dietary guidelines? Because of the attractive but confusing array of foods available at the supermarket, consumers confront as many as 10,000 different options when purchasing food. A comparable difficulty attends the selection of food in the various establishments where much of the U.S. national diet is consumed at the present time. An infinite number of choices may be made en route to an unbalanced diet. The issue, thus, is how to make intelligent food choices. To be sure, a food is rarely selected just for its nutritional value. But it seems reasonable to try to make nutritional value an important consideration. Obviously, time constraints, availability of convenient foods, attractive packaging, and appetite appeal may sometimes be overriding considerations. For many individuals, however, nutrition is becoming a significant issue in food choices, and that enhances public interest in and acceptance of educational efforts. The most widely recognized system of nutrition education focusing on food is the one that was developed by the U.S. Department of Agriculture, with its recommendations for consumption of foods from four basic food groups. This system needs no elaboration before this audience.

The new version (1979 release date) of the food group method of balancing a diet is called "Food." It recognizes a fifth group that includes foods high in fat, or sugar, or alcohol. Many of these foods are of low nutrient density (and, antithetically, high calorie density). Individuals whose calorie needs are least should, therefore, minimize their intakes of foods in this fifth category.

To assist consumers in making the transition from nutrient allowances to food choices at Utah State, we have been experimenting with a system to highlight nutritional quality of food based on nutrient density. This will now be described. For an individual to achieve and maintain proper weight for age, the amount of food consumed over a period of time must equate with his/her energy needs with high precision. The foods eaten to satisfy energy requirements must also satisfy the individual's allowances for all other nutrients. Admittedly, requirements for the various nutrients and, therefore, allowances based upon those requirements are not strictly related to energy in some cases. Nevertheless, expressing dietary allowances in terms of energy permits a number of useful applications.

Expressing the nutrient composition of the food supply, the diet, or an individual food and the human dietary allowances for individual nutrients on the same basis—that is, nutrients per 1,000 kcal—permits a direct comparison between the two parameters, and quality judgments may be derived. By exploiting the resulting ratio, an assessment of a food supply or food combination to meet dietary allowances becomes possible, and food manufacturers, Government agencies, and consumers have an easy means of understanding the nutritional contributions of a food to a balanced diet. Such ratios permit foods to be examined (and compared) with respect to ability to meet dietary allowances relative to the calories provided.

To obtain a single-value allowance for each nutrient, its RDA must first be converted into an allowance per 1,000 kcal. This is done by dividing each RDA by the average calorie allowance and multiplying by 1,000; the results are shown in table 1. The allowances for many nutrients per 1,000 kcal are constant, or approximately constant, thus simplifying the choice of the single value of these nutrients. For those nutrients whose values are not constant, the single-value allowances should be largely based on the allowances for those persons whose nutrient-to-calorie needs are greatest, that is, those with the lowest calorie needs, since they find it most difficult to meet other dietary allowances.

In many situations it would be helpful to have guidelines for intakes of fat and carbohydrate. Since no authoritative body has delineated an advisable intake, we have arbitrarily defined a standard of 35 percent of calories or 39 grams per 1,000 kcal. The remaining of the calories would be provided by carbohydrate, or 187.5 grams per 1,000 kcal. We believe that the 35 percent of calories from fat is a reasonable guide, since palatable diets can be planned within this standard, using readily available foods. As an average in the United States, the proportion of polyunsaturated (P) to saturated (S) fatty acids is currently about 0.7 (9), which many regard as appropriate. Thus, for our calculations, the P:S ratio of 0.7 was chosen.

Table 2 summarizes the recommended single-value allowances per 1,000 kcal. These allowances can be used as guidelines in describing the nutritional quality of food, and they permit comparisons between calorie allowances and those for other nutrients.

To further assist consumers and professional nutritionists, advisable recommended dietary allowances for certain vitamins and trace elements are included in the 9th edition of the RDA's. Limitation of information regarding nutrient content of many foods and an inadequate knowledge of requirements for those nutrients prevent their being listed in the general summary table. A need has emerged for establishing allowances for some nutrients not listed in the summary table; thus where it is insufficient to warrant establishing an allowance in the traditional sense, an advisable or safe and adequate daily dietary intake has been suggested. Such allowances are less well documented by research and observation and should be regarded as somewhat tentative and evolutionary in nature. As more research information becomes available, these allowances may expect to assume the status of those listed in the general table. Table 3 is a list of the estimated safe and adequate daily dietary intake given in terms of nutrients per 1,000 kcal.

Requirements for pantothenic acid and biotin, as well as their occurrence in food, are known with less certainty than for other vitamins; hence, it is appropriate that allowance for them imply more of a "provisional" status. The function of vitamin K in human metabolism has been well established; however, a dietary need has not been well defined except in newborn infants prior to establishment of intestinal flora. Thus its inclusion at this time is warranted.

Some nutritionists feel that our consumption of sodium is too high; therefore, an advisable RDA for sodium is suggested to help those who wish to control the amount of sodium consumed. Since sodium, potassium, and chloride are important in maintaining proper electrolyte balance, an estimated safe and adequate daily dietary intake is also suggested.

Perhaps the most cogent argument for estimated safe and adequate daily dietary intakes can be developed relative to requirements for trace elements which are not listed in the general table; namely, copper, manganese, chromium, selenium, and molybdenum. Fluoride is clearly recognized as needed to promote growth of experimental animals being fed purified diets. It is becoming increasingly evident that the function of fluoride in bone and teeth development in human beings is positive and fundamental. To reduce the incidence of dental caries, it has become customary to add fluoride to the water supply. Therefore, it is appropriate to state the "allowance" for fluoride as parts per million, or milligrams per liter of water, rather than per 1,000 kcal.

Requirements of the human for sulfur and cobalt are met with sulfur-containing amino acids and vitamin B_{12}, respectively. There is sometimes an exogenous need for choline and inositol for animals and micro-organisms; there is no evidence, however, of special needs in human beings beyond what is normally consumed in food and biosynthetic capacity. Claims of unusual nutritional benefits for inositol and choline consumption are unfounded, and a provisional allowance for either compound is unwarranted at this time. Finally, elements such as tin, vanadium, silicon, and arsenic are probably nutritionally important for some species, but data for human beings are not available.

A 1974 report of the Food and Nutrition Board of the National Academy of Science recommended that the standard enrichment of flour and cereal products be extended to include more trace nutrients. Cereals are an important calorie source for many people, especially for the poor (20 to 30 percent of calories). Since vitamin B_6, zinc, and magnesium may be consumed in limited quantities by a growing segment of the population, such nutrients might advantageously be included in flour and cereal products. For some trace elements (i.e., selenium and copper), however, the dietary level is adequate and the range between adequate intake and toxicity is narrow. Hence, some caution should be exercised in widespread enrichment or fortification efforts.

An expectation has been created among consumers that consumption of limited quantities of some fortified foods will provide all of the recommended dietary allowances for all nutrients. Out of this has come the formulation of "foods" similar to the preparations available for intravenous feeding. These parenteral and enteral preparations presumably contain all of the required nutrients in reasonable proportions.

The expanded list of nutrients in the 1979 edition of the RDA includes additional vitamins and trace minerals, the importance of which in food can better be understood in terms in intrinsic versus extrinsic occurrence. If some of the "leader" reference nutrients are intrinsically present in a food, positive qualitative assumptions are generally justified relative to the occurrence of many other nutrients. This is especially true if processing has not removed nutrients, and if the food was derived from a plant or animal source that was once alive. Admittedly, the balance among nutrients may differ from that recommended for human consumption, nevertheless, most trace nutrients can be expected to be plant- or animal-derived. On the other hand, if the reference nutrients have been added (i.e., occur extrinsically), the food may not serve as a reasonable source of the nutrients not added. This discussion assumes that it is important to consume most nutrients in some approximation of their RDA proportions, an assumption that may be especially significant because of complex dietary interactions with the trace minerals. Particularly for educational purposes, the occurrence of leader or reference nutrients in foods should be referenced as being there "intrinsically" or "extrinsically."

The next consideration logically follows, what of the reference nutrients (those commonly referred to in education programs and most generally added to fortified food) in any education program? There may be other nutrients more appropriate to accent in describing food quality to the consumer. Currently it is clear that the energy yielding components of food are of much public interest, and more attention must be given to these. On the other hand, a substantial proportion of the calcium and riboflavin in the American diet comes from milk. With that in mind, should both calcium and riboflavin be referenced as "leader" nutrients in an educational program? Protein, and also tryptophane (a metabolic precursor of niacin) intake, are almost without exception adequate diets in the United States. Furthermore, most flour is enriched with niacin. All of these conditions combine to make the risk of pellagra almost nonexistent in the United States. Hence, niacin may not be appropriate as a leader nutrient. A strong case may be developed, however, for adding vitamin B_6, zinc, copper, and perhaps others, to any list used for educational purposes.

While the National Research Council in 1974 emphasized the need to add or broaden our food enrichment policies to include other trace nutrients, the Food and Drug Administration has not responded. Meanwhile, the Surgeon General advises us to reduce our intakes of meat, an important source of nutrients largely discarded in the flour milling process. Hence, the two agencies seem to be offering contradictory advice to the consumer. In other words, either the cereal and flour enrichment formulations should include those nutritional elements that are discarded in the milling process, or we should continue to consume meat, which is an especially good source of most of those trace nutrients.

Currently there is a considerable amount of professional and consumer interest in the labeling of foods. The ingredients, the principle sources of energy, the nutrients individually, and salt and cholesterol content are all major considerations. With the limited size of food containers and the interest and capacity of the consumer to assimilate the information, what is ultimately placed on the label should be carefully reviewed, rationalized, and evaluated, and a complementary educational program developed.

Whatever labeling information and format is finally adopted, without an extensive educational program it may not be effective. It has been our experience that educational programs can have a meaningful beginning on an elementary level. Our work suggests that graphically presented nutrition information at this level can alter food consumption patterns. Furthermore, we have been able to measure consumer response to various types of labeling formats and have discovered that graphical methods or presenting nutrition information are readily understood and accepted by consumers at the point of food purchase. Whatever labeling system emerges should be accompanied by an extensive educational program in the schools and with the public.

In most nutrition surveys, the persons at greatest risk are frequently on the low end of the economic scale. While, admittedly, there are others of the population who consume deficient quantities of specific nutrients, it is generally true that those with the least resources are at the greatest risk of nutritional deficiency. There is also a consensus that obesity is the major nutritional problem in the United States. Obesity is more of a problem with the economically disadvantaged, but is likewise a problem for people of all economic levels. But it is surprising that it occurs so frequently among the poor (who also are at the greatest risk for other nutrient deficits), who probably are engaged in occupations that require more physical activity. It seems a contradiction to discover people who are deficient in nutrients, yet overweight. For whatever reason, the argument can be made that an education program based on nutrient density could help discriminate when alternative food choices are available.

Practically, consumers—whether children or adults, male or female—generally obtain their dietary allowances from a common table or restaurant menu, making choices according to individual preference. Thus those whose calorie needs are minimal, or who have special dietary needs, may find it exceedingly difficult to meet their dietary allowances. For that reason, nutrient allowances cited in this text per 1,000 kcal, when not a constant as derived, have been largely based on the allowances established for individuals whose nutrient-to-energy needs are greatest. Those who, for one reason or another, want to reduce their calorie consumption below their energy allowance, would need to select foods having a high nutrient density. For example, a 1,000 calorie weight-reduction diet, in order to be nutritionally adequate, should supply most nutrients and protein in approximately double the allowances cited per 1,000 calories.

Allowances per 1,000 calories should be used by public agencies as standards for estimating food requirements for health and welfare programs, or other public assistance. Food choices and menus should include a wide variety of palatable, acceptable foods. An individual food or even a meal, cannot reasonably be expected to contain full allowances for all nutrients. However, over a period of time, which may range from days to weeks, depending on the nutrient under consideration, the food consumed in total should include all nutrients at allowance levels in proportion to calories.

For a general population, the nutrient allowance per 2,000 kcal would be a particularly useful standard. For a group of people of specified age or sex, however, their more specific allowances should provide the frame of reference. The amounts of foods that will meet the total nutrient and energy needs of that population can thus be calculated.

In developing and marketing new products that may displace traditional foods, it would seem more appropriate to use the nutrient composition of the food displaced as a guide for fortification rather than a standard derived from RDA's. Each new product would, insofar as possible, match the recognized significant nutrients of the food it displaces. On the other hand, for new products, that are not identified in any way with traditional products, but which might become important sources of energy, RDA's expressed per 1,000 kcal could provide a standard for nutritional formulation.

Guidelines are usually provided to illustrate how nutrient needs can be met by selecting from among a relatively few groups of foods. Such food groupings and food guides are useful for illustrating the essential elements of a basic diet. It is important, however, that such guides be adapted and modified imaginatively to meet the needs of individuals and families with different levels of income, cultural patterns, and lifestyles. Categorization of a food as either good or bad is meaningless because individual foods must be considered in terms of how they contribute to the balance of nutrients in an overall diet within energy needs. The RDA's for nutrients can be obtained from a wide variety of food combinations and dietary patterns—any of which can be adequate, provided care is exercised in food selection. To make the transition from nutrients to foods which both professionals must do, nutrient density provides a useful reference base. From that base, for dietary consideration, favorite foods or recipes may serve as an initial starting point so that within calorie restrictions, appropriate food choices may be made in order to achieve a balanced intake of nutrients.

TABLE 1.—NUTRIENT ALLOWANCES PER 1,000 KCAL DERIVED FROM RECOMMENDED DIETARY ALLOWANCES (NAS NRC 1979)

Age (years)	Energy (kcal)	Protein (g)	Fat-soluble vitamins: Vitamin A (ug R.E.)	Vitamin D (ug)	Vitamin E (mg α T.E.)	Water-soluble vitamins: Vitamin C (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg N.E.)	Vitamin B_6 (mg)	Folacin (ug)	Vitamin B_{12} (ug)	Minerals: Calcium (mg)	Phosphorus (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)	Iodine (ug)
Children:																		
1 to 3	1,300	18	303	8	4	35	0.5	0.6	7	0.7	77	1.5	615	615	115	11.5	7	54
4 to 6	1,700	18	294	6	4	27	.5	.6	7	.8	118	1.5	471	417	118	5.9	6	53
7 to 10	2,400	14	292	4	3	19	.5	.6	7	.7	125	1.3	333	333	104	4.2	4	50
Males:																		
11 to 14	2,700	17	370	4	3	19	.5	.6	7	.7	148	1.1	444	444	130	6.7	6	56
15 to 18	2,800	20	257	4	4	21	.5	.6	6	.7	143	1.1	429	429	143	6.4	5	54
19 to 22	2,900	19	345	3	3	21	.5	.6	7	.8	138	1.0	276	276	121	3.5	5	52
23 to 50	2,700	21	370	2	4	22	.5	.6	7	.8	148	1.1	296	296	130	3.7	6	56
51 plus	2,400	23	417	2	4	25	.5	.6	7	.9	167	1.3	333	333	146	4.2	6	63
Females:																		
11 to 14	2,200	21	264	5	4	23	.5	.6	7	.8	182	1.4	546	546	136	8.2	7	68
15 to 18	2,100	22	381	5	4	29	.5	.6	7	1.0	191	1.4	571	571	143	8.6	7	71
19 to 22	2,100	21	381	4	4	29	.5	.6	7	1.0	191	1.4	381	381	143	8.6	7	71
23 to 50	2,000	22	400	3	4	30	.5	.6	7	1.0	200	1.5	400	400	150	9.0	8	75
51 plus	1,800	24	444	3	4	33	.5	.7	7	1.1	222	1.7	444	444	167	5.5	8	83

TABLE 2.—*Single-value nutrient allowances per 1,000 kcal*

Vitamin A	400 mg.	Phosphorus	450 mg.
Vitamin D	4 μg.	Magnesium	150 mg.
Vitamin E	4 mg α T.E.	Iron	8 mg.
Vitamin C	30 mg.	Zinc	8 mg.
Thiamin	0.5 mg.	Iodine	75 μg.
Riboflavin	0.6 mg.	Protein	25 g.
Niacin	7 mg N.E.	Carbohydrate	187.5 g.
Vitamin B_6	1.0 mg.	Fat	39.0 g.
Folacin	200 μg.	Oleic F.A	12.25 g.
Vitamin B_{12}	1.5 μg.	Linoleic F.A	10.0 g.
Calcium	450 mg.	Saturated F.A	14.25 g.

TABLE 3.—ESTIMATED SAFE AND ADEQUATE DAILY DIETARY INTAKES

	Range for adults	Per 1,000 kcal
Vitamin K	70 to 140 μg	30 μg.
Biotin	100 to 200 μg	50 μg.
Pantothenic acid	4 to 7 mg	2 mg.
Copper	2.0 to 3.0 mg	1 mg.
Manganese	2.5 to 5.0 mg	1.5 mg.
Flouride	1.5 to 4.0 mg	1 mg/l of H_2O.
Chromium	0.05 to 0.2 mg	0.03 mg.
Selenium	0.05 to 0.2 mg	0.035 mg.
Molybdenum	0.15 to 0.5 mg	0.08 mg.
Sodium	1,100 to 3,300 mg	1,500 mg.
Potassium	1,875 to 5,625 mg	2,500 mg.
Chloride	1,700 to 5,100 mg	1,500 mg.