Recommended Dietary Allowances should be used to set Daily Values for nutrition labeling\textsuperscript{1–3}

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ABSTRACT

Guiding principles were recently suggested for revising the Daily Values (DVs) used for nutrition labels on foods and dietary supplements. These principles incorporate the new Dietary Reference Intakes, which are nutrient standards issued between 1997 and 2005 by the Institute of Medicine. Most of the principles are likely to lead to a more accurate basis for the DVs. However, the recommendation to use the Estimated Average Requirement (EAR) rather than the Recommended Dietary Allowance (RDA) should be reconsidered. Traditional public health messages to American and Canadian consumers have focused on nutrient intake levels with a high probability of being adequate. The RDA, with a 98\% probability of adequacy, is designed to be the target nutrient intake for individuals; in contrast, the EAR has only a 50\% probability of adequacy. Three considerations should lead to a preference for using the RDA rather than the EAR for the DVs: 1) consumers are likely to expect that a product (or a diet) with 100\% of the DV has a high probability of nutrient adequacy; 2) use of the RDA for the DV will be consistent with other types of dietary guidance, such as the Dietary Guidelines for Americans 2005 and US food guides; and 3) use of the RDA as a standard for nutrient intake, rather than the EAR, has a potential benefit (a higher prevalence of adequate intakes) that exceeds potential risk (a higher prevalence of excessive intakes). Am J Clin Nutr 2006; 83(suppl):1223S–7S.

KEY WORDS

Nutrition labeling, Daily Values, Recommended Dietary Allowances, RDA, Dietary Reference Intakes, DRI

INTRODUCTION

In 2003 a committee of the Food and Nutrition Board of the Institute of Medicine issued a report recommending guiding principles for nutrition labeling and fortification in both the United States and Canada (1). The recommendations for revision of the nutrition standards used on food and dietary supplement labels are particularly important because the standards are substantially out of date. The US standards are based primarily on the 1968 Recommended Dietary Allowances (RDAs), whereas the Canadian standards are based on the 1983 Recommended Nutrient Intakes. As the committee noted, it is appropriate to use the new Dietary Reference Intakes (DRIs) as the basis for these reference values.

The reference values in the Nutrition Facts box of food and supplement labels (Figure 1 and Figure 2) are called Daily Values (DVs). These are intended to serve several purposes for consumers, including 1) enabling comparison of similar products and 2) allowing the consumer to understand the contribution of an individual food or supplement to an overall health-promoting diet.

The committee proposed 10 guiding principles covering a range of topics related to nutrition labeling and the DVs. Most of the principles are likely to lead to a more accurate basis for the DVs; however, one should be reconsidered: “GUIDING PRINCIPLE 3. A population-weighted Estimated Average Requirement (EAR) should be the basis for Daily Values (DVs) for those nutrients for which EARs have been identified” (1; p 82). This guiding principle would be more appropriate if it were revised to propose that “A population-weighted Recommended Dietary Allowance (RDA) should be the basis for Daily Values (DVs) for those nutrients for which RDAs have been identified.” Because intake at the RDA level has a 98\% probability of adequacy compared with 50\% at the EAR level (2), the RDA should be the target for an individual’s nutrient intake.

It is important to note that only vitamins and minerals are covered by Guiding Principle 3. Although both proteins and carbohydrates have EARs, the committee suggested that Acceptable Macronutrient Distribution Ranges be used as the basis for these DVs (Guiding Principle 5). For vitamins and minerals with an Adequate Intake (AI), the committee suggested that the AI be used as the basis for the DVs (Guiding Principle 4). We agree that both the Acceptable Macronutrient Distribution Ranges and the AIs are appropriate standards for these DVs.

The following sections discuss why we recommend the RDA as the basis for the DVs for vitamins and minerals. Our concerns with the EARs arise from differing perspectives in 3 general areas:

1) perceptions of how consumers interpret the DVs on the Nutrition Facts and Supplement Facts panels on products,

2) assumptions about the potential of the DVs in nutrition education, and

3) evaluation of the benefits versus the risks of using lower standards for the DVs.

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HOW DO CONSUMERS INTERPRET THE NUTRITION FACTS LABEL?

Relatively little is known about the ways consumers use the Nutrition Facts and Supplement Facts panels on food and supplement labels. Although a recent review by Cowburn and Stockley (3) identified 103 articles on consumer understanding or use of nutrition labels, only a few (9%) were judged to be of high or medium-high quality. One of these, a survey of 1331 Canadian adults, reported that 83% of those who used the nutrition information on the label often or sometimes used it to see how high or low a food was in nutrients such as fiber, vitamins, or minerals (4). Cowburn and Stockley (3) also summarized 17 studies of how consumers use a label to assess a product in the context of a meal choice or daily intake. Although it was clear that some type of benchmark, such as the DVs, helped consumers judge the overall healthiness of a product, no recommendations were made on the basis of the reference values.

To our knowledge, no surveys have assessed how consumers interpret the %DV for vitamins and minerals. Research by Levy et al (5) on consumer understanding of the %DV on food labels pertained only to the %DV for fat, which differs conceptually from the %DV for vitamins and minerals. The DV for fat is a “recommended maximum” rather than a level that will ensure adequacy. It is unclear how consumers interpret the DVs or how they would assess products that provide various percentages of them. Studies of consumers’ use of the DVs are needed.

Public health advice to consumers in the United States and Canada has traditionally focused on nutrient intake levels and diets with a high probability of being adequate. We thus contend that a consumer would logically expect a diet with 100% of the DV for a vitamin or mineral to have a high probability of meeting his or her needs. However, a DV that is a weighted average of the EARs for persons 4 y of age and older will meet the needs of only 50% of Americans and Canadians in this age range. In contrast, a DV based on the RDAs will meet the needs of 98% of the population (2, 6).

Although more surveys are needed, it seems unlikely that a consumer would be satisfied with a product that meets 100% of the DV but still has only a 50% probability of meeting his or her needs. An RDA-based 100% DV will not have a 98% probability of being adequate for every individual (because a population-weighted DV will be below the RDA for some and above it for others). However, it will be closer than a DV that is based on an EAR.

The committee specifically stated that the label was not to be used to plan diets, but it is not clear whether consumers recognize this limitation. Indeed, many consumers might assume that a product with 25% of the DV of a vitamin or mineral would supply ~25% of their recommended intake. For dietary supplements, it seems very likely that a consumer would assume that a product with 100% of the DV has a high probability of being adequate for every individual (because a population-weighted DV will be below the RDA for some and above it for others). However, it will be closer than a DV that is based on an EAR.

The newsletter for a large health care organization in Hawaii recently stated, “And in your daily diet try to eat foods that total up to 100% of your Daily Values of total carbohydrates, fiber, vitamins, and minerals.” (7).

To address a lack of information on how consumers use nutrition information, the committee posed 14 questions (1; pp 151–152). These focus on gaining a better understanding of how the %DV affects consumer choices and overall diet quality. It seems only prudent to attempt to answer these questions before revising the DVs on the food and supplement labels.

ROLE OF THE DVs IN NUTRITION EDUCATION

The Nutrition Labeling and Education Act of 1990 includes a focus on consumer education. Thus, it is important that the label not confuse consumers or health professionals. Traditional public health messages stress a choice of diets that provide nutrient levels associated with minimal risk of inadequacy, ie, diets that meet the RDA. This approach was reiterated in the DRI reports. Since the first of these reports (8), the RDA has been the target intake specified for individuals. The most recent DRI report states, “The RDA is intended to be used as a goal for daily intake

How do consumers interpret the Nutrition Facts label on food and supplement labels? Little is known about the ways consumers use these labels. A recent review identified 103 articles, but only a few were judged to be of high or medium-high quality. One study of 1331 Canadian adults found that 83% of those who used nutrition information on the label used it to see how high or low a food was in nutrients such as fiber, vitamins, or minerals. Public health advice traditionally focuses on nutrient intake levels and diets with a high probability of being adequate. However, consumers may not expect a product with 100% of a vitamin or mineral to have a high probability of meeting their needs. More research is needed to understand how consumers interpret the %DV for vitamins and minerals. The committee specifically stated that the label was not to be used for planning diets, but it is not clear whether consumers recognize this limitation. A product with 25% of the DV of a vitamin or mineral would supply 25% of their recommended intake, but consumers might assume a product with 100% of the DV has a high probability of being adequate for every individual. More surveys are needed to assess how consumers interpret the %DV for vitamins and minerals. The committee posed 14 questions to gain a better understanding of how the %DV affects consumer choices and overall diet quality. It seems prudent to attempt to answer these questions before revising the DVs on the food and supplement labels.
by individuals” (9; p 23). Reports on appropriate uses of the DRIs elaborate on these concepts (2, 6).

The report on the use of the DRIs for nutrition labels infers that the EAR is the intake goal (1). This inference is inconsistent with recommendations in preceding DRI reports, which state that the RDA is a goal for individual intake. If one of the objectives of the nutrition label is to help individuals understand how a food or supplement fits into an overall healthy diet, it is inappropriate to use the EAR as the basis for the DV. To consumers, a diet that meets the DV for a nutrient may appear adequate, when in fact it has only (on average) a 50% chance of meeting a person’s needs if the DV is based on the EAR.

The source of the inconsistency appears to be earlier statements from the Food and Drug Administration that the label is not intended for planning the overall structure of the diet (1; p 40)—a restriction not noted in the charge to the committee (1; p 15). One concern is that the DV on the label is seldom the correct target for a specific individual because it is a composite value. Currently, the DV is the highest RDA for nonpregnant, nonlactating individuals aged ≥4 y, and in the future it may be a weighted average of multiple recommendations. However, the concept of planning specific diets based on DVs differs from that of using them to approximate the target for daily intakes. The RDA would be the appropriate basis for a daily intake target.

The labeling report justifies the use of the EAR for the DVs by noting that it is the value closest to an individual’s actual requirement—as indicated by the definition of the EAR (1). Although it is true that the EAR is the best estimate of an individual’s requirement, this does not automatically make it the most appropriate standard for the DV. The question is, should the target for daily intakes be based on the average requirement (which by definition is inadequate for 50% of persons) or on the RDA (which is adequate for all but 2–3%)?

To provide a safety factor that ensures a low probability of inadequacy, the RDA is intentionally set higher than the requirement for most individuals. Consumers may not fully appreciate the difference between “average requirements” and “recommended intakes.” However, they would reasonably expect that dietary guidance would ensure a high probability of meeting their needs. Thus, the targets used on the labels should correspond to this expectation to the highest degree possible.

The DVs on the labels of most products are seldom the correct targets for a specific individual because of heterogeneity of requirements among different age and sex groups. However, for labeling categories other than “4 y of age and older,” there is considerably less heterogeneity. In particular, the categories for pregnant and lactating women have little variation in the requirements for most nutrients (1; pp 177–178). For these groups, the %DV on the label can be directly used by consumers to determine whether dietary choices are meeting recommended levels. It seems likely that a pregnant woman (and her obstetrician) would assume that a prenatal vitamin labeled as containing 100% of the DV would meet her iron requirement. With a DV based on the RDA of 27 mg/d for pregnant women, the probability that her assumption would be correct is 98%. However, with a DV based on the EAR of 22 mg/d, the probability would fall to 50%. The same would be true for other specific categories of requirements, such as those for infants and toddlers. For these consumers, use of the EAR as a basis for the DV may be particularly misleading.

Throughout the DRI reports, a distinction has been made between appropriate uses of the DRIs for individuals versus population groups. The 2 reports on the correct uses of the DRIs (2, 6) note the importance of the distribution of usual intakes and the usefulness of the EAR in both planning and assessing the diets of groups. Although the EAR is not the desirable target for the mean intake of a group, it may be used as a “cutoff” to estimate the prevalence of inadequacy within a population group. The proportion of the usual intake distribution below the EAR often approximates the prevalence of inadequate intakes in the group (2).

The statistical concepts that underlie the intakes of groups are new to many health professionals, and the correct approaches have only slowly been accepted. Because the EAR is used in planning group intake distributions (albeit indirectly), confusion exists in the professional community about whether to use the EAR as a target for individual intakes. This is so even though the DRI reports consistently state that the RDA is the appropriate target for an individual’s usual intake (over many days). Thus, use of the EARs as the basis for the DVs is not only inconsistent with the stated uses of the DRIs but also likely adds to uncertainty about how to correctly use the DRIs in many different situations.

Guiding Principle 4 specifies that a population-weighted AI is an appropriate DV for nutrients without an EAR (1). Use of AIs for the DVs is consistent with the recommendation that an AI may be used as the target for an individual’s intake (2). Because the RDA is also specified as the appropriate target for an individual’s intake, using a combination of AIs and EARs (rather than RDAs) as the basis for DVs will further add to confusion about how to appropriately use the DRIs.

It is important that consumer education materials convey a consistent message about dietary goals. The original Food Guide Pyramid (10) has recently been revised (11) to reflect the RDAs and AIs from the DRI reports. For example, an oils group was added to the pyramid to help consumers meet the vitamin E RDA. Likewise, the Dietary Guidelines for Americans 2005 considered the RDAs for micronutrients when making recommendations for appropriate eating plans (12). Thus, it would be confusing to base the label on a different standard. Consumers should expect consistency across all types of guidance.

AN EVALUATION OF RISKS AND BENEFITS IS NEEDED

The risks and benefits of using the EAR versus the RDA for the nutrition label should be carefully evaluated. If the lower levels represented by the EAR are used, manufacturers of fortified foods and supplements might reduce the level of nutrients in their products. If manufacturers reduce fortification levels, and the levels of nutrients in supplements, intakes are likely to decline. This change may be desirable for nutrients that are overconsumed (eg, zinc for young children), but not for the many that are underconsumed (eg, iron for pregnant women). Although excessive consumption is not currently seen as a public health problem in the United States, numerous nutrients are known to have a high prevalence of inadequate intake (11). If overfortification and overuse of supplements leads to undesirably high intakes, reducing the DVs does not seem to be the most effective means of addressing the problem.

For most nutrients, the RDA is calculated from the EAR. Two times the SD is added to estimate the RDA if the requirement distribution is normal. For most nutrients, the CV is assumed to
be 10%, so the RDA is ~20% higher than the EAR. The CVs are higher for niacin (15%) and for vitamin A (20%). Thus, as shown in Table 1, a population-weighted RDA would be 20–40% higher than a population-weighted EAR. The DV for iron is more problematic because the requirement distribution is skewed, especially for menstruating women (13). Thus, a weighted RDA would be >40% higher than a weighted EAR, but would have the advantage of being much closer to the RDA for menstruating women. In that the magnitude of the difference is small for most nutrients, the choice might logically be driven by considerations other than the direct impact of the DV on nutrient intakes (eg, the consistency of educational messages).

One concern is that a population-weighted RDA might exceed the Tolerable Upper Intake Level (UL) for some of the specific age and sex groups. For example, for children aged 4–8 y, the ULs for both vitamin A and zinc (900 μg retinol activity equivalents/d and 12 mg Zn/d) are close to the RDAs (400 μg retinol activity equivalents/d and 5 mg Zn/d) (13). However, as shown in Table 2, a weighted RDA would still be below the UL for children aged 4–8 y. Some of the weighted RDAs appear close to the ULs, but the UL is based only on fortification and supplemental sources of several of these nutrients. In the case of magnesium, the UL applies only to pharmacologic sources and not to magnesium found in food and water (8).

Use of numbers that are closest to the actual requirement for an individual may be mathematically appealing. However, from a public health perspective, such an approach appears to have no meaningful benefits and considerable potential for risk.

### POSSIBLE NEXT STEPS

Several steps could be taken to resolve these issues on how to set DVs. Conducting surveys or focus groups to determine how consumers interpret the DVs for micronutrients would be useful [eg, do they expect 100% of the DV to provide enough of a nutrient to ensure a low prevalence of inadequacy (2–3%) or is a level that provides enough for a 50% probability of inadequacy acceptable?] Likewise, it would be important to determine whether a lower DV on the label will alter consumer choices, particularly when considering fortified foods or dietary supplements.

In addition to examining the effect on consumer choices, it is important to understand the potential impact of the new DVs on a manufacturer’s formulation of foods and dietary supplements. For example, if the DVs are lower, will manufacturers reduce the levels of nutrients in products that now provide a specific level (such as 100%) of the DV?

Finally, the information on predicted consumer and manufacturer changes might be used to simulate the effect on dietary intakes. For example, to see what impact changes might have on the prevalence of inadequacy and excessive intakes, national dietary survey data could be evaluated by using different food and supplement composition data that reflect likely changes by manufacturers. Likewise, simulations could be performed to examine the effect of changes consumers might make if the DVs are altered. Such a health risk assessment would provide valuable information that could inform changes in the food and supplement labels.

### CONCLUSIONS

The 2 broad goals for the DVs on nutrition labels are to allow consumers to compare similar products and evaluate how a product fits into an overall healthy diet (1). For the purpose of comparing products, many types of DVs could be used, including a simple ranking scheme. However, for evaluating the contribution of a food or supplement to a healthy diet, the DV should be consistent with targets used in other types of dietary guidance and consumer education materials. Because the nutrition label has great potential for consumer education, care should be taken to avoid use of numbers that will confuse rather than inform.

Use of lower values, such as the EAR, may also result in reductions in levels of nutrients added to foods and supplements by manufacturers. An outcome that could lead to undesirable reductions in intakes. An evaluation of both the health risks and benefits of using the EAR versus the RDA should be undertaken.

The potential for harm as well as benefit should be more carefully examined before the EAR is used as the standard for the DVs. It
is important to better understand the public health impact of such changes.

In summary, the RDA, rather than the EAR, should be used as the basis for the DVs for nutrition labeling for several important reasons:

- Consumers are likely to expect that a product (or a diet) with 100% of the DV has a high probability of nutrient adequacy, not a 50% probability of adequacy.
- Use of the RDA for the DV will be consistent with other types of dietary guidance, such as the Dietary Guidelines for Americans and the current food guide for the United States.
- The potential benefit of using the RDA (a higher prevalence of adequate intakes) is likely to exceed the potential risk (a higher prevalence of excessive intakes).

SPM and SIB both participated in the development of this article’s concepts, SPM prepared the initial draft, and both authors contributed to the final revision. Both authors vouch for the contents. The authors had no conflicts of interest to report.

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